Service Training Manual

Bedford Trucks & Coaches

Gasoline & Diesel Engines

TS1084

SERVICE TRAINING MANUALS FOR 1973 BEDFORD TRUCKS AND COACHES CONSIST OF THE FOLLOWING:

Title	Ref No
GASOLINE & DIESEL ENGINES	TS 1084
TRANSMISSION & REAR AXLE	TS 1085
FRONT AXLE, SUSPENSION & WHEELS, STEERING, CAB	TS 1086
BRAKES	TS 1087
ELECTRICAL EQUIPMENT & INSTRUMENTS	TS 1088
ALTERNATOR CHARGING SYSTEMS	TS 951

The manuals listed above can be obtained through Vauxhall and Bedford authorised dealers, or direct from the Service Department, Route 3329, Vauxhall Motors Ltd, Luton LU2 0SY, England.

IMPORTANT SAFETY NOTICE

Proper service and repair is important to the safe, reliable operation of all motor vehicles. The service procedures recommended by Vauxhall Motors Ltd, and described in this manual are effective methods for performing service operations. Some of these service operations require the use of tools specially designed for the purpose. The special tools should be used when and as recommended.

It is important to note that some warnings against the use of specific service methods that can damage the vehicle or render it unsafe are stated in this manual. It is also important to understand these warnings are not exhaustive. Vauxhall Motors Ltd could not possibly know, evaluate and advise the service trade of all conceivable ways in which service might be done or of the possible hazardous consequences of each way. Consequently, Vauxhall Motors Ltd has not undertaken any such broad evaluation. Accordingly, anyone who uses a service procedure or tool which is not recommended by Vauxhall Motors Ltd must first satisfy himself thoroughly that neither his safety nor vehicle safety will be jeopardized by the service method he selects.

BEDFORD
Service Training Manual

GASOLINE AND DIESEL ENGINES

Bedford Trucks & Coaches

VAUXHALL MOTORS LTD LUTON ENGLAND

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CONTENTS

INTRODUCTION 5

SPECIFICATIONS 7

RECOMMENDED LUBRICANTS 22

220 AND 330 cu in. DIESEL ENGINES 25

466 cu in. DIESEL ENGINE 53

214 cu in. GASOLINE ENGINE 81

300 cu in. GASOLINE ENGINE 101

FUEL AND EXHAUST—Diesel Engines 111

FUEL AND EXHAUST—Gasoline Engines 153

COOLING SYSTEM 165

CLUTCH 175

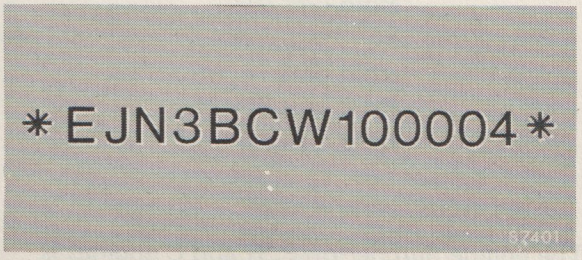
INTRODUCTION

This manual provides the experienced serviceman with information on the special features of 214 and 300 cu in. gasoline, and 220, 330 and 466 cu in. diesel engines used on 1973 Bedford trucks and coaches, except Series M 4 x 4 trucks, which are covered by a separate publication (TS 1015)

The section headings throughout the manual are numbered consecutively so that cross reference can be made between chapters thus avoiding duplication of similar information.

VEHICLE IDENTIFICATION

The model designation and chassis number is stamped on the chassis frame left-hand side-member, adjacent to the rear spring hanger.



A service parts identification plate is attached to the left-hand seat support. This plate bears the following information in the sequence shown:

Model and Chassis No. Destination Job No.

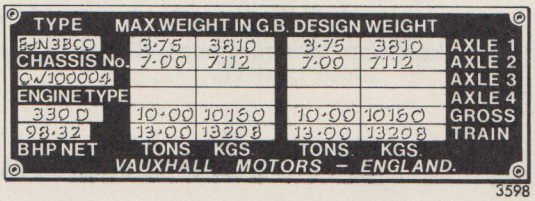
Paint Code Trim Code

Option Codes

Special Conversion Order No. (as applicable)

Special Vehicle Order No. (as applicable)

On domestic vehicles, a weight specification plate is riveted to the cab floor panel, adjacent to the left-hand seat support.

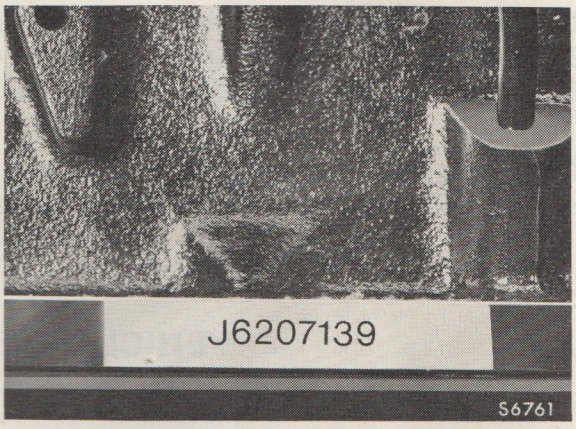


UNIT IDENTIFICATION

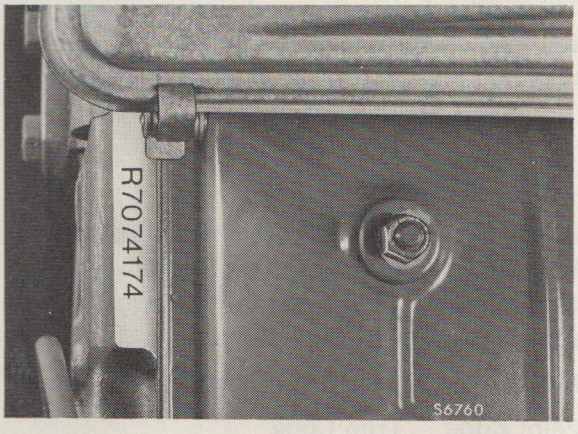
The engine number is prefixed by a letter which identifies the unit as follows:

Engine	Prefix Letter
214 cu in. Gasoline	D
300 cu in. Gasoline	F
220 cu in. Diesel	H
330 cu in. Diesel	J
466 cu in. Diesel (derated)	P
466 cu in. Diesel (truck)	R
466 cu in. Diesel (coach)	C

The engine number on D, F, H and J engines is stamped on a machined pad on the lower right-hand side of the crankcase.



The engine number on P, R and C engines is stamped on a machined pad on the right-hand rear of the cylinder block.



RITEWAY SERVICE TOOLS

Reference is made in the Manual to Riteway Tools designed to facilitate service operations. Enquiries and orders for these tools should be addressed to Kent-Moore Ltd, 19-21 Stockfield Rd, Acocks Green, Birmingham, B27 6AJ, England.

SUPPLEMENTARY INFORMATION

The information given in this manual is correct at the time of preparation but Vauxhall Motors Ltd reserves the right to introduce specification changes which may affect this information. To keep the manual up to date with design changes which affect servicing procedure or specification data, supplements are issued from time to time.

SPECIFICATIONS

Dimensions quoted are the manufacturing limits for new parts except where maximum and minimum permissible figures are given.

CAPACITIES—Nominal

Engine Oil Pan

214 cu in. Gasoline and 220 cu in. Diesel Engines	
Dry engine	14 Imp pints
Refill with filter element change	12 Imp pints
Refill	10 Imp pints
300 cu in. Gasoline and 330 cu in. Diesel Engines	
Dry engine	17 Imp pints
Refill with filter element change	16 Imp pints
Refill	14 Imp pints
466 cu in. Diesel Engine	
Dry engine	24 Imp pints
Refill with filter element change	23 Imp pints
Refill	21 Imp pints

Cooling System

214 cu in. Gasoline Engine	
C trucks	29 Imp pints
E trucks	31 Imp pints
300 cu in. Gasoline Engine	
C trucks	35 Imp pints
E trucks	37 Imp pints
220 cu in. Diesel Engine	
C trucks	28 Imp pints
E trucks	31 Imp pints
330 cu in. Diesel Engine	
C trucks	31 Imp pints
E trucks	37 Imp pints
466 cu in. Diesel Engine	
E and HRX trucks	48 Imp pints

With heater fitted, add 1.5 Imp pints on C trucks and 2.0 Imp pints on E and HRX trucks

For coach coolant capacities refer to coachbuilder's specifications as capacity varies with heater system used

214 cu in. GASOLINE ENGINE

Firing Order	1, 5, 3, 6, 2, 4
Compression Ratio	7.0 to 1
Compression Pressure at Cranking Speed—Hot	*110 lb/ft minimum

* *Maximum variation between cylinders is 20 lb/sq in.*

Oil Pressure—Hot	25–35 lb/sq in.

Cylinder Head

Permissible Depth after Refacing	3.735 in. minimum
Permissible Distortion on Attachment Face	
Longitudinally	0.005 in. maximum
Transversely	0.003 in. maximum
Manifold attaching faces	0.003 in. maximum
Valve Seating Angle	
Intake	30°
Exhaust	45°
Valve Seating Width	
Intake	0.035/0.060 in.
Exhaust	0.062/0.093 in.
Valve Guide Height above Head	1.078 in.

Valves

Stem Diameter	
Intake	0.3410/0.3417 in.
Exhaust	0.3397/0.3407 in.
Stem Clearance in Guide	
Intake	0.001/0.003 in.
Exhaust	0.002/0.004 in.
Seat Angle	
Intake	29°
Exhaust	44°
Valve Head Thickness	0.035 in. minimum
End of Exhaust Valve Stem to Cotter Land—Minimum permissible length	0.2005 in.
Rotator Cap Clearance	0.001/0.005 in.

Valve Springs

Free Length—Nominal	2.463 in.
Spring Load at 1.52 in.	119 lb minimum

Valve Tappets

Diameter	0.9890/0.9895 in.
Clearance in Guide	0.0005/0.0020 in.

Valve Clearance—Hot

Intake	0.010 in.
Exhaust	0.013 in.

Valve Timing

Intake Valve Maximum Opening Point	106° after TDC

Rockers and Shaft

Shaft Diameter	0.7909/0.7916 in.
Rocker Clearance on Shaft	0.0009/0.0026 in.

Camshaft and Bearings

Journal Diameter	
No. 1 (front)	1.8190/1.8195 in.
No. 2	1.7882/1.7887 in.
No. 3	1.7570/1.7575 in.
No. 4	1.5630/1.5635 in.
Clearance in Bearings	0.0025/0.0040 in.
End Float	0.002/0.004 in.
Permissible Dimension, Cam Peak to Base	
Intake	1.464 in. minimum
Exhaust	1.488 in. minimum
Thrust Plate Thickness	0,183/0.187 in.

Piston Rings

Ring Gap in Cylinder Bore	
Top ring	0.011/0.022 in.
Centre ring	0.008/0.021 in.
Scraper ring	0.020/0.040 in.
Thickness (top to bottom face)	
Top and centre rings	0.0925/0.0932 in.
Clearance in Piston Groove	
Top ring	0.0016/0.0033 in.
Centre ring	0.0011/0.0028 in.
Scraper ring	0.0027/0.0087 in.

Piston Pins

Clearance in Connecting Rod Bush	0.0001/0.0003 in.
Fit in Piston	Firm hand push fit in each boss separately at 20–25° C

Pistons

Clearance in Cylinder Bore at 20° C	0.00175/0.00275 in.

Cylinder Block

Bore Diameter—Standard	3.375 in. nominal
Permissible Depth of Block After Refacing (top face to main bearing cap face)	10.735 in.
Permissible Distortion on Top Face	
Longitudinally	0.005 in. maximum
Transversely	0.003 in. maximum

Cylinder Liners

Bore Diameter For Liner Installation	3.530/3.531 in.
Maximum Piston Oversize for use with Liners	0.040 in.

Connecting Rods

Bearing Housing Bore Diameter	2.2210/2.2215 in.
End Float on Crankpin	0.006/0.012 in.

Crankshaft and Bearings

Crankpin Diameter—Standard	2.095/2.096 in.
Crankpin Clearance in Bearing	0.002/0.004 in.
Crankpin Fillet Radius	0.078/0.109 in.
Crank Throw	1.9975/2.0025 in.
Main Journal Diameter—Standard	
No. 1 (front)	2.1025/2.1035 in.
No. 2	2.2585/2.2595 in.
No. 3	2.2895/2.2905 in.
No. 4	2.3215/2.3225 in.
Main Journal Clearance in Bearing	0.0020/0.0043 in.
Main Journal Fillet Radius	0.078/0.110 in.
Crankshaft End Float	0.002/0.012 in.
Main Bearing Housing Bore	
No. 1 (front)	2.1055/2.1068 in.
No. 2	2.2615/2.2628 in.
No. 3	2.2925/2.2938 in.
No. 4	2.3245/2.3258 in.
Thrust Washer Thickness—Standard	0.133/0.135 in.
Front Intermediate Main Journal—Regrind length	
0.003 in. oversize thrust washers	1.396/1.400 in.
0.006 in. oversize thrust washers	1.402/1.406 in.
0.009 in. oversize thrust washers	1.408/1.412 in.

Oil Pump

Driving Spindle End Float	0.005/0.010 in.
Oil Pressure Relief Valve	
Plunger diameter	0.5605/0.5613 in.
Plunger clearance in bore	0.0007/0.0025 in.
Spring free length—nominal	3.38 in.
Spring load at 2.44 in.	11 lb 2 oz—11 lb 6 oz

Oil Pressure Switch Operating Pressure	3—5 lb/sq in.

Torque Wrench Data

Cylinder Head Bolts	*93 lb ft
Rocker Shaft Bracket Bolts	25 lb ft
Connecting Rod Nuts	*42 lb ft
Crankshaft Main Bearing Bolts	
Front and intermediate	*115 lb ft
Rear	†68 lb ft
Flywheel Bolts	48 lb ft

** Oiled threads † Threads coated with sealer*

220, 300 and 330 cu in. ENGINES

Firing Order

Four-cylinder engine	1, 3, 4, 2
Six-cylinder engines	1, 5, 3, 6, 2, 4

Compression Ratio

Gasoline engine	7 to 1
Diesel engines	17 to 1

Compression Pressure at Cranking Speed—Gasoline Engine—Hot *110 lb/sq in. minimum

** Maximum variation between cylinders is 20 lb/sq in.*

Compression Pressure at 550 rev/min—Diesel Engines—Hot 540 lb/sq in. minimum

Oil Pressure—Hot 35—50 lb/sq in.

Cylinder Head

Permissible Depth of Head after Refacing	
Gasoline engine	4.402 in. minimum
Diesel engines	4.2385 in. minimum
Permissible Distortion on Attachment Face	
Longitudinally	0.005 in. maximum
Transversely	0.003 in. maximum
Manifold attaching face	0.003 in. maximum
Valve Seating Angle	
Intake	30°
Exhaust	45°
Valve Seating Width	
Gasoline engine:	
Intake	0.035/0.050 in.
Exhaust	0.062/0.093 in.
Diesel engines:	
Intake	0.055/0.069 in.
Exhaust	0.097/0.110 in.
Valve Guide Height above Head	
Intake	0.76 in.
Exhaust:	
Gasoline engine	0.80 in.
Diesel engines	0.89 in.

Valves

Stem Diameter	
Intake	0.3409/0.3417 in.
Exhaust	0.3397/0.3407 in.
Stem Clearance in Guide	
Intake	0.0010/0.0028 in.
Exhaust	0.002/0.004 in.
Seat Angle	
Intake	29°
Exhaust	44°
Valve Head Thickness	0.035 in. minimum
Valve Depth Below Head Face—Diesel engines	
Intake	0.023 in. minimum
Exhaust	0.041 in. minimum
End of Exhaust Valve Stem to Cotter Land—Gasoline engine	0.2005 in. minimum
Rotator Cap Clearance—Gasoline engine	0.001/0.005 in.

Valve Springs

Free Length—Nominal	1.95 in.
Spring Load at 1.68 in.	45—65 lb
Assembled Height	
Gasoline engine	1.78 in. maximum
Diesel engines	1.74 in. maximum

Valve Tappets

Diameter	1.1235/1.1240 in.
Clearance in Guide	0.0005/0.0020 in.

Valve Clearance—Hot

Gasoline Engine	0.010 in.
Diesel Engines	0.013 in.

Valve Timing

Intake Valve Maximum Opening Point	108° after TDC

Rockers and Shaft

Shaft Diameter	0.8729/0.8736 in.
Rocker Clearance on Shaft	0.0009/0.0026 in.

Camshaft and Bearings

Journal Diameter	
No. 1 (front)	2.1360/2.1365 in.
No. 2	2.0460/2.0465 in.
No. 3	2.0030/2.0035 in.
No. 4	1.9730/1.9735 in.
Clearance in Bearings	0.0025/0.0040 in.
End Float	0.002/0.012 in.
Permissible Dimension, Cam Peak to Base	1.653 in. minimum
Thrust Plate Thickness	0.253/0.258 in.

Piston Rings—Gasoline Engine

Ring Gap In Cylinder Bore	
Top ring	0.012/0.023 in.
Second and scraper rings	0.007/0.021 in.
Thickness (top to bottom face)	
Top and centre rings	0.0927/0.0937 in.
Scraper rings	0.1865/0.1875 in.
Clearance in Piston Groove	
Top ring	0.0014/0.0034 in.
Second ring	0.0009/0.0029 in.
Scraper rings	0.0010/0.0027 in.

Piston Rings—Diesel Engines

Ring Gap in Cylinder Bore	
Top and scraper rings	0.013/0.025 in.
Second and third rings	0.006/0.023 in.

Thickness (top to bottom face)	
Top, second and third rings	0.0927/0.0937 in.
Scraper rings	0.1865/0.1875 in.
Clearance in Piston Groove	
Top ring	0.0046/0.0066 in.
Second, third and scraper rings	0.0015/0.0035 in.

Piston Pins

Clearance in Connecting Rod Bush	
Gasoline engine	0.0002/0.0011 in.
Diesel engines	0.0004/0.0011 in.
Fit in Piston	Firm hand push fit in each boss separately, at 20—25°C

Pistons

Clearance in Cylinder Bore at 20°C	
Gasoline engine	0.0035/0.0045 in.
Diesel engines	0.0099/0.0111 in.
Protrusion above Cylinder Block Face—Diesel engines	0.025/0.036 in.

Cylinder Block

Bore Diameter—Standard	
Gasoline engine	3.875 in. nominal
Diesel engines	4.063 in. nominal
Permissible Depth of Block after Refacing (top face to oil pan face)	
Gasoline engine	12.519 in. minimum
Permissible Distortion on Top Face	
Longitudinally	0.005 in. maximum
Transversely	0.003 in. maximum

Cylinder Liners

Bore Diameter for Liner Installation	
Gasoline engine	4.057/4.058 in.
Diesel engines	4.246/4.247 in.
Maximum Piston Oversize for use with Liners	0.020 in.

Connecting Rods

Bearing Housing Bore Diameter	2.5195/2.5200 in.
End Float on Crankpin	0.006/0.012 in.

Crankshaft and Bearings

Crankpin Diameter—Standard	2.374/2.375 in.
Crankpin Clearance in Bearing	0.002/0.004 in.
Crankpin Fillet Radius	0.162/0.167 in.
Crank Throw	2.1235/2.1265 in.
Main Journal Diameter—Standard	2.749/2.750 in.
Main Journal Clearance in Bearing	0.0020/0.0045 in.
Main Journal Fillet Radius	0.162/0.167 in.
Crankshaft End Float	0.002/0.012 in.

Main Bearing Housing Bore	2.916/2.917 in.
Thrust Washer Thickness—Standard	0.091/0.093 in.
Centre Main Journal—Regrind length	
0.003 in. oversize thrust washers	1.816/1.820 in.
0.006 in. oversize thrust washers	1.822/1.826 in.

Oil Pump

Driving Spindle End Float	0.003/0.006 in.
Oil Pressure Relief Valve	
Plunger diameter	0.6235/0.6243 in.
Clearance in bore	0.0007/0.0025 in.
Spring free length—nominal	4.56 in.
Spring load at 2.58 in.	17—18 lb

Oil Pressure Switch Operating Pressure	3—5 lb/sq in.

Torque Wrench Data

Cylinder Head Nuts—Gasoline engine	* 100 lb ft
Cylinder Head Bolts—Diesel engines	† 152 lb ft
Rocker Shaft Bracket Bolts	
Gasoline engine	14 lb ft
Diesel engines	42 lb ft
Connecting Rod Nuts	63 lb ft
Crankshaft Main Bearing Bolts	† 85 lb ft
Crankshaft Pulley Bolt	190 lb ft
Flywheel Bolts	85 lb ft
Camshaft and Fuel Injection Pump/Compressor Gear Nuts	90 lb ft
Engine Rear Mounting Bracket Bolts—P and N coaches	80 lb ft

** Greased nuts and washers † Oiled threads*

466 cu in. DIESEL ENGINE

Firing Order	1, 5, 3, 6, 2, 4
Compression Ratio	17 to 1
Compression Pressure at 550 rev/min—Hot	540 lb/sq in. minimum
Oil Pressure—Hot	40—45 lb/sq in.

Cylinder Head

Permissible Depth after Refacing	3.385 in. minimum
Permissible Distortion on Attachment Face	
Longitudinally	0.005 in. maximum
Transversely	0.003 in. maximum
Manifold attaching faces	0.003 in. maximum
Valve Seating Angle	
Intake	30°
Exhaust	45°
Valve Seating Width	
Intake	0.054/0.072 in.
Exhaust	0.088/0.100 in.

Valves

Stem Diameter—Standard	
Intake	0.3410/0.3417 in.
Exhaust	0.3397/0.3407 in.
Stem Clearance in Guide	
Intake	0.0010/0.0027 in.
Exhaust	0.0023/0.0040 in.
Seat Angle	
Intake	29°
Exhaust	44°
Valve Head Thickness	0.035 in. minimum
Valve Depth below Head Face	
Intake	0.022 in. minimum
Exhaust	0.048 in. minimum

Valve Springs

Free Length—Nominal	1.980 in.
Spring Load at 1.36 in.	175 lb minimum

Valve Tappets

Diameter	1.1235/1.1240 in.
Clearance in Guide	0.0005/0.0020 in.

Valve Clearance—Hot

Intake and Exhaust	0.013 in.

Valve Timing

Intake Valve Maximum Opening Point	108° after TDC

Rockers and Shaft

Shaft Diameter	0.8729/0.8736 in.
Rocker Clearance on Shaft	0.0009/0.0026 in.

Camshaft and Bearings

Journal Diameter	
No. 1 (front)	2.1360/2.1365 in.
No. 2	2.1140/2.1145 in.
No. 3	2.0910/2.0915 in.
No. 4	1.9730/1.9735 in.
Clearance in Bearings	0.0025/0.0040 in.
End Float	0.002/0.012 in.
Permissible Dimension, Cam Peak to Base	1.747 in. minimum
Thrust Plate Thickness	0.253/0.258 in.

Piston Rings

Ring Gap in Cylinder Bore	
Top ring	0.023/0.036 in.
Second, third and scraper rings	0.018/0.031 in.
Thickness (top to bottom face)	
Top, second and third rings	0.0927/0.0937 in.

Scraper rings	0.1865/0.1875 in.
Clearance in Piston Groove	
Top ring	0.0025/0.0045 in.
Second and third rings	0.0015/0.0035 in.
Scraper rings	0.0015/0.0025 in.

Piston Pins

Clearance in Connecting Rod Bush	0.0010/0.0017 in.
Fit in Piston	Firm hand push fit through each boss individually at 20°C

Pistons

Clearance in Cylinder Bore at 20°C	0.0105/0.0145 in.
Protrusion above Cylinder Block Face	0.024/0.034 in.

Cylinder Block

Bore Diameter—Standard	4.562 in. nominal
Permissible Distortion on Top Face	
Longitudinally	0.005 in. maximum
Transversely	0.003 in. maximum

Cylinder Liners

Bore Diameter for Liner Installation	4.7050/4.7065 in.
Maximum Piston Oversize for use with Liners	0.020 in.

Connecting Rods

Bearing Housing Bore Diameter	2.6460/2.6465 in.
End Float on Crankpin	0.008/0.014 in.

Crankshaft and Bearings

Crankpin Diameter—Standard	2.4985/2.4995 in.
Crankpin Clearance in Bearing	0.002/0.004 in.
Crankpin Fillet Radius	0.140/0.145 in.
Crank Throw	2.3735/2.3765 in.
Main Journal Diameter—Standard	3.4985/3.4995 in.
Main Journal Clearance in Bearing	0.0020/0.0045 in.
Main Journal Fillet Radius	0.172/0.177 in.
Crankshaft End Float	0.002/0.012 in.
Main Bearing Housing Bore	3.666/3.667 in.
Thrust Washer Thickness—Standard	0.091/0.093 in.
Centre Main Journal—Regrind length	
0.003 in. oversize thrust washers	1.940/1.944 in.
0.006 in. oversize thrust washers	1.946/1950 in.

Oil Pressure Relief Valve

Plunger Diameter	0.6230/0.6235 in.
Plunger Clearance in Cover	0.0015/0.0030 in.
Spring Free Length	2.44 in.
Spring Load at 1.90 in.	16 lb 8 oz—17 lb 8 oz

Oil Pressure Switch Operating Pressure	5–7 lb/sq in.

Torque Wrench Data

Camshaft Gear Bolt	52 lb ft
Fuel Injection Pump Gear Nut	90 lb ft
Oil Pump Idler Gear Shaft Nut	45 lb ft
Rocker Shaft Bracket Bolts	43 lb ft
Cylinder Head Bolts	*105 lb ft
Connecting Rod Bolt Nuts	*87 lb ft
Crankshaft Pulley Bolt	190 lb ft
Main Bearing Cap Bolts	*102 lb ft
Flywheel Housing Bolts	85 lb ft
Flywheel Bolts	97 lb ft

** Oiled threads*

FUEL SYSTEM–Gasoline Engines

Fuel Grade	90 octane minimum

Fuel Pump

Delivery Pressure	1½–2½ lb/sq in.
Diaphragm Spring Load at 0.64 in.	5–5½ lb

Zenith 34VN Carburetter

Choke Tube	29 mm (single bar)
Main Jet	115
Compensating Jet	100
Idling Jet	65
Idling Jet Air Bleed Plug	50
Emulsion Block Ventilation Screw	2 mm
Pump Jet	70
Needle Valve	2.25 mm
Needle Valve Washer Thickness	2 mm
Fuel Level-Float removed	33 mm below bowl top face
Idling Speed	450–500 rev/min
Permissible Exhaust CO at Idling Speed	See text
High Altitude Jet Settings	
Main jet:	
5000–7000 ft	112
7000–10 000 ft	110
10 000–15 000 ft	105
Compensating jet:	
5000–7000 ft	97
7000–15 000 ft	95

Zenith 37VNR Carburetter

Choke Tube	32 mm (3 bars)
Main Jet	130
Compensating Jet	100
Idling Jet	65

Idling Jet Air Bleed Plug	50
Emulsion Block Ventilation Screw	2 mm
Pump Jet	70
Needle Valve	2.25 mm
Needle Valve Washer Thickness	2 mm
Float Level—Float removed	33 mm below bowl top face
Idling Speed	450–500 rev/min
Governor Cut-off	3500 rev/min
Permissible Exhaust CO at Idling Speed	See text
High Altitude Jet Settings	
Main jet:	
5000–7000 ft	112
7000–10 000 ft	110
10 000–15 000 ft	105
Compensating jet:	
5000–7000 ft	97
7000–15 000 ft	95

Zenith 48VIR Carburetter

Choke Tube	36 mm (no bars)
Main Jet	150
Compensating Jet	140
Idling Jet	70
Pump Jet	80
Needle Valve	2.5 mm
Needle Valve Washer Thickness	1.6 mm
Fuel Level—Float removed	27–33 mm below bowl top face
Idling Speed	450–500 rev/min
Governor Cut-off	3200 rev/min
Permissible Exhaust CO at Idling Speed	See text
High Altitude Jet Settings	
Main Jet:	
5000–7000 ft	147
7000–10 000 ft	145
10 000–15 000 ft	140
Compensating jet:	
5000–7000 ft	137
7000–15 000 ft	135

Crankcase Ventilator Valve

Valve Spring Load at 0.42 in.	4–5 oz

FUEL SYSTEM—Diesel Engines

Fuel Feed Pump

Delivery Pressure	
220 cu in. engine	6–10 lb/sq in.
330 and 466 cu in. engines	5–8 lb/sq in.

Fuel Injectors—220 and 330 cu in. Engines

Make and Type	CAV multi-hole

Despatch Number	5254120
Nozzle Holder Type Number	BKBL 97S5153
Nozzle	
Type number	BDLL 160SY6584
Spray holes:	
Number	4
Diameter	0.26 mm
Delivery Pressure	175 atmospheres

Fuel Injectors—466 cu in. Engines

Make and Type	CAV multi-hole
Despatch Number	5225401
Nozzle Holder Type Number	BKBL 87S5189
Nozzle	
Type number	BDLL 160S6492
Spray holes:	
Number	4
Diameter	0.3 mm
Delivery Pressure	175 atmospheres

Fuel Injection Pump—220 cu in. Engine

Make and Type	Simms SPE 4M 80 S755
Identification Number	P5202
Governor Make and Type	Simms GPD 70M17
Engine Governed Speed	
Idling	500—625 rev/min
*Maximum—no load	2940 rev/min
Spill Timing	22° BTDC

Fuel Injection Pump- 330 cu in. Engines

Make and Type	CAV, DPA 3266F 739
Setting Code	A/52/850/0/3000
Engine Governed Speed	
Idling	500—550 rev/min
*Maximum—no load	3000 rev/min

Fuel Injection Pump—466 cu in. Engines

Make and Type	CAV, DPA 3268F 810
Setting Code	
Derated truck engine (P)	A/53/800/4/2920
Truck engine (R)	A/73/800/7/2750
Coach engine (C)	A/73/800/4/3080
Engine Governed Speed	
Idling	500—550 rev/min
*Maximum—no load:	
Derated truck engine (P)	2920 rev/min
Truck engine (R)	2750 rev/min
Coach engine (C)	3080 rev/min

** Final adjustment to be made on engine, not on test equipment*

Fuel injection pump setting or calibration should be carried out in accordance with the current test data published by the manufacturer of the injection equipment

Torque Wrench Data

Injector Securing Nuts	6 lb ft
Injector Leak-off Pipe Bolts	4 lb ft
Simms Fuel Injection Pump	
Delivery valve holders	30 lb ft
Coupling to pump shaft nut	46 lb ft
Coupling clamp bolts	14 lb ft
Pump to support bracket bolt	15 lb ft
CAV Fuel Injection Pump	
Carrier to support bracket bolt	15 lb ft
Governor housing securing nuts (mechanically governed pump)	40 lb in.

COOLING SYSTEM

Fan Belt Tension 0.30 in. using thumb pressure (80 lb tension gauge reading). Measure on slacker of dual belts

Anti-freeze Data

Percentage solution by volume of Vauxhall ethylene glycol anti-freeze required for complete protection down to the following temperatures:

–11°C	*25%
–14°C	30%
–19°C	35%
–23°C	40%
–29°C	45%
–35°C	†50%

** Standard factory fill † Factory fill for Code 230*

Thermostat Opening Temperature 77–82°C

Radiator Filler Cap

Pressure Valve Opening Pressure 6¼–7½ lb/sq In.

CLUTCH

Pedal Setting–See text

YRQ Coach	3.25 in.
YRT Coach	Self-setting
Other Models	1.00 in.

Pedal Free Travel

TOP Coach	0.74 in.
YRT Coach	Self-adjusting
Other Models (except YRQ)	1.00 in.

Fork Free Travel–YRQ Coach 0.24 in.

Pedal Shaft—Left drive C trucks, N and P coaches

Shaft Diameter	0.7415/0.7425 in.
Clearance in Bushes	0.003/0.006 in.

Pressure Plate Thrust Springs

10 in. Clutch	
Number	12
Assembled height	1.688 in.
Load at assembled height	150—160 lb
Identification colour	Black
12 in. Clutch	
Number	16
Assembled height	1.69 in.
Load at assembled height	105—115 lb
Identification colour	Light green
13 in. Clutch	
Number	16
Assembled height	1.688 in.
Load at assembled height	135—145 lb
Identification colour	Yellow/light green
14 in. Clutch	
Number	12
Assembled height	2.10 in.
Load at assembled height	175½—190½ lb
Identification colour	Cream
15 in. Clutch	
Number	12
Assembled height	2.10 in.
Load at assembled height	200—220 lb
Identification colour	Red

Pressure Plate—Permissible Thickness after Refacing

10 in. Clutch	0.630 in. minimum
12 and 13 in. Clutches	0.735 in. minimum
14 in. Clutch	1.350 in. minimum
15 in. Clutch	1.425 in. minimum

Release Lever Height

10 in. Clutch	1.945/1.965 in. using gauge plate 0.33 in. thick
12 and 13 in. Clutches	2.225/2.275 in. using gauge plate 0.33 in. thick
14 in. Clutch	2.440/2.460 in. using gauge plate 0.465 in. thick and spacers 1.499/1.501 in. long
15 in. Clutch	2.515/2.535 in. using gauge plate 0.465 in. thick and spacers 1.574/1.576 in. long

Maximum variation between lever heights is 0.015 in.

Torque Wrench Data

Drive Strap Bolts	
12 and 13 in. clutches	18 lb ft
14 and 15 in. clutches	31 lb ft
Clutch to Flywheel Bolts	
10, 12 and 13 in. clutches	24 lb ft
14 and 15 in. clutches	39 lb ft

RECOMMENDED LUBRICANTS — Overseas

Usage	SAE Viscosity Number	Specification
Engine Above 32° C 32 to 0° C 0 to −12° C −12 to −23° C Below −23° C for long periods	 30 20 or 20W 20W 10W 5W	MIL−L−46152 or MIL−L−2104B
Clutch Fork Ball Clutch Release Levers, Pins and Struts Clutch Release Bearing Hub Transmission Front Cover Sleeve	—	GM4530−M
Main Drive Pinion Splines Water Pump Bearings Brake Pedal Bearing Rollers	—	GM 4733−M
Clutch Pedal and Shaft Bushes− Series C, N and P Clutch Linkage Accelerator Pedal Linkage	—	GM 4550M
Clutch Pedal and Shaft Bushes− Series E, HRX, Y and T Relay and Idler Lever Bushes−YRQ	—	Special compound of molybdenum disulphide and extreme viscosity fluids
Oil Seals	—	Paste of heavy mineral oil with 25% by weight of molybdenum disulphide
Water Pump Seal	—	Castor oil base grease harmless to rubber

RECOMMENDED LUBRICANTS — United Kingdom

Usage	BP	Castrol	Duckhams	Esso	Gulf	Mobil	Petrofina	Shell	Texaco
Engine	BP Vanellus 20W or 10W/30	Castrol/ Deusol CRB 20W/20 or 10W/30 or 20W/50	Fleetol HDX 20 or Fleetol V or Multilite	Essolube HDX 20W or 10W/30 or 20W/50	Gulflube Motor Oil XHD 20/20W or 20W/40 or 20W/50	Delvac 1220 or Delvac Special 10W/30	Fina Delta Motor Oil 20W/20 or 10W/30 or 20W/50	Shell Rotella TX 20/20W or 20W/40	Ursa Oil Extra Duty 20/20W or 10W/30 or 10W/40
Clutch Fork Ball Clutch Release Levers, Pins, and Struts Clutch Release Bearing Hub Transmission Front Cover Sleeve	BP Energrease L21M	Castrol MS 3 Grease	CG Grease or LBM 10 Grease	Esso Graphite Grease or Esso MP Grease (Moly)	Gulf Graphite Grease No. 1 or Gulflex (Moly)	Mobilgrease Super	Fina Marson LM2	Shell Retinax AM	Regent Grease 904 or Molytex Grease 2
Main Drive Pinion Splines Water Pump Bearings Brake Pedal Bearing Rollers	BP Energrease L2	Castrol LM Grease	LB. 10 Grease	Esso Multi-purpose Grease H	Gulflex A	Mobilgrease MP	Fina Marson HTL2	Shell Retinax A	Marfak All Purpose
Clutch Pedal and Bushes— Series C, N and P Clutch Linkage Accelerator Pedal Linkage	—	—	Keenol Grease	—	—	—	—	—	—
Clutch Pedal and Shaft Bushes— Series E, HRX, Y and T Relay and Idler Lever Bushes— YRQ	Rocol M204G Grease								
Oil Seals		Rocol Anti-scuffing paste							
Water Pump Seal	—	Castrol/ Girling Rubber Grease (Red)	Q. 4590 Rubber Grease	TSD 803 Grease	—	—	—	—	—

220 and 330 cu in. DIESEL ENGINES

VALVE TIMING CHECK 27

VALVE CLEARANCE ADJUSTMENT 28

ENGINE FRONT MOUNTINGS 29

ENGINE REAR MOUNTINGS 30

VALVE ROCKERS AND PUSH RODS 31

CYLINDER HEAD AND VALVES 33

VALVE TAPPETS 36

OIL FILTER 36

OIL PAN 37

OIL PUMP 37

CRANKSHAFT PULLEY AND TIMING COVER 39

CAMSHAFT 40

TIMING GEARS 40

AIR COMPRESSOR/EXHAUSTER 42

TIMING CASE 43

FLYWHEEL 43

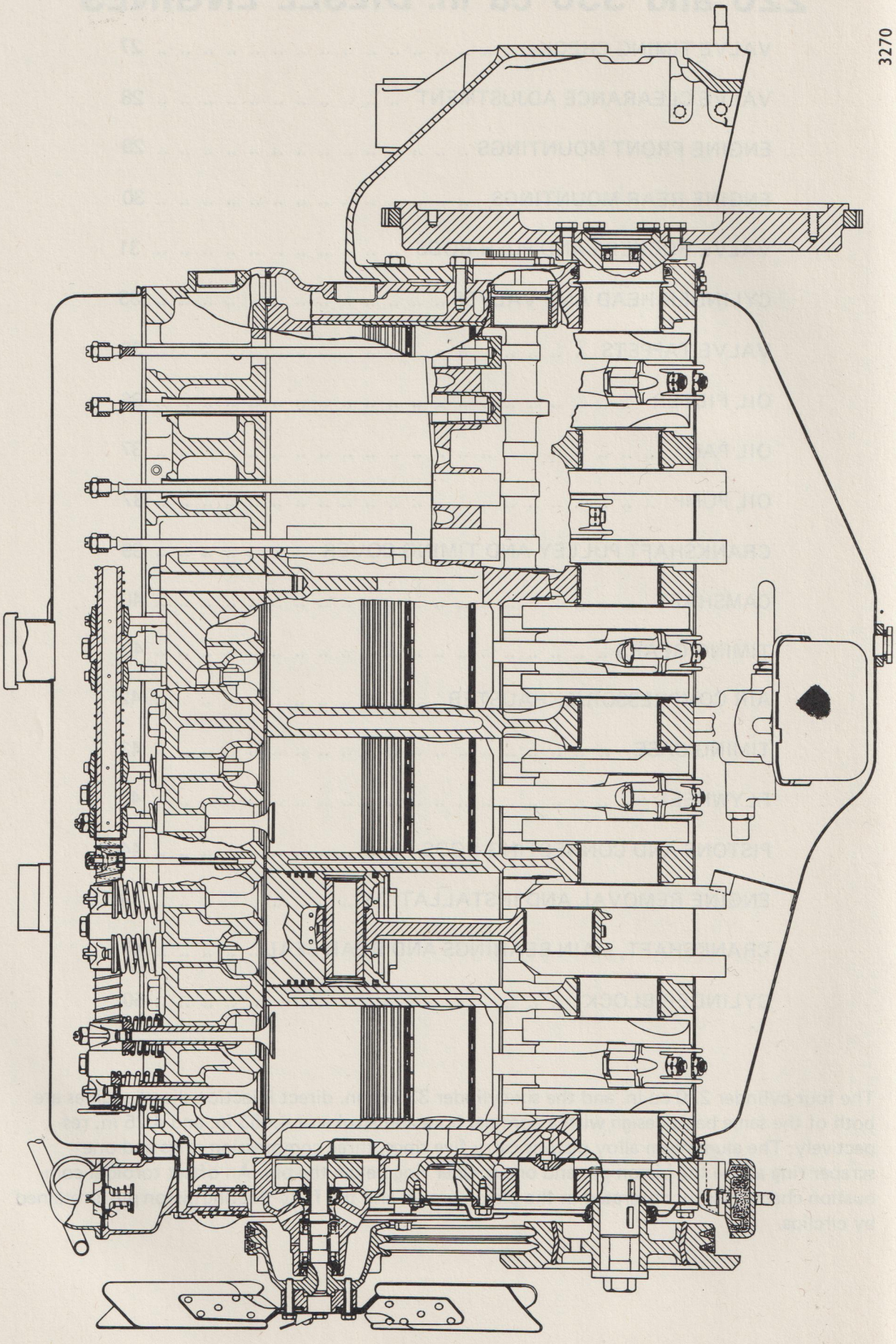
PISTONS AND CONNECTING RODS 44

ENGINE REMOVAL AND INSTALLATION 46

CRANKSHAFT, MAIN BEARINGS AND REAR SEAL 47

CYLINDER BLOCK 50

The four-cylinder 220 cu in. and the six-cylinder 330 cu in. direct injection diesel engines are both of the same basic design with a nominal bore and stroke of 4.063 in. and 4.25 in. respectively. The aluminium alloy pistons carry five rings, three compression rings and one scraper ring above the piston pin and one scraper ring below the pin. An offset toroidal combustion chamber is incorporated in the piston crown and the fully-floating piston pin is retained by circlips.



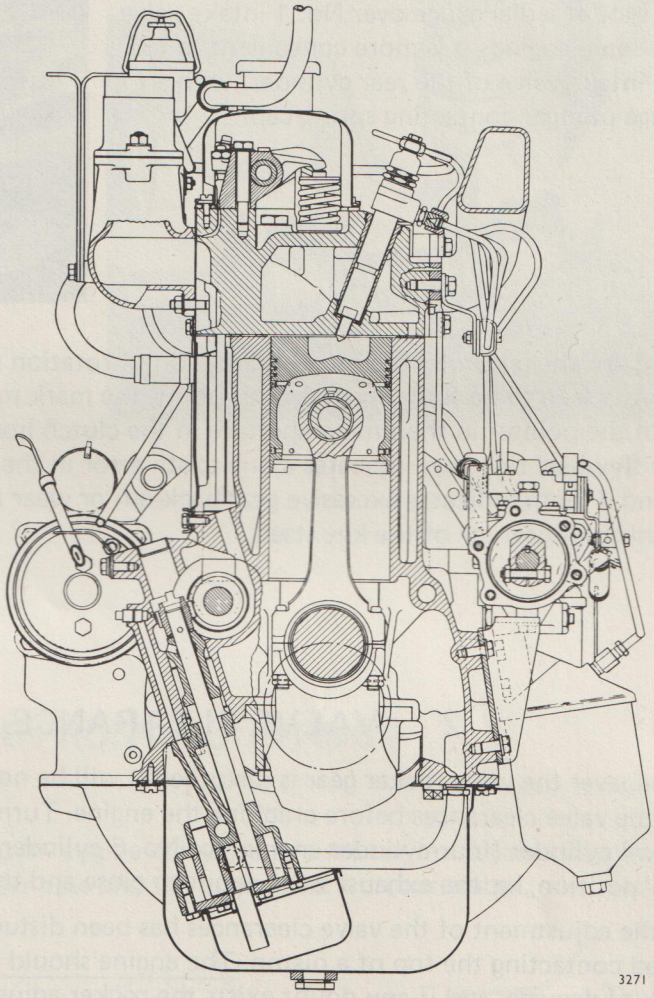
3270

The crankshaft of the 220 cu in. engine is supported by five main bearings whereas the crankshaft of the 330 cu in. unit is supported by seven. Crankshaft end float is controlled by thrust washers located on each side of the centre main bearing. A spring-loaded lip-type oil seal is provided at the front end and a braided-fabric type seal at the rear. The crankshaft pulley on the 330 cu in. engine incorporates a rubber-insert type vibration damper.

The camshaft is supported by four bearings, and is driven by a helical gear train from the crankshaft. An integral skew gear on the camshaft drives the oil pump and tachometer drive. Shaft end float is controlled by a thrust plate located behind the camshaft gear and bolted to the crankcase. The valves, carried in renewable guides are operated via the rocker gear by tappets and push rods.

The gear-type oil pump is mounted in the right-hand side of the crankcase and its driving spindle is carried direct in the bore of the pump body.

The helical gear, keyed to the lower end of the shaft, meshes with a driven impeller which rotates on a spindle in the pump body. Oil is fed via a full flow filter to the main gallery and through drillings in the cylinder block to the crankshaft and camshaft. Lubrication of the timing gears is by a jet of oil from the front main bearing. The valve rockers are lubricated via an oil feed pipe located in a cylinder head drilling which corresponds with an oil passage in the cylinder block.

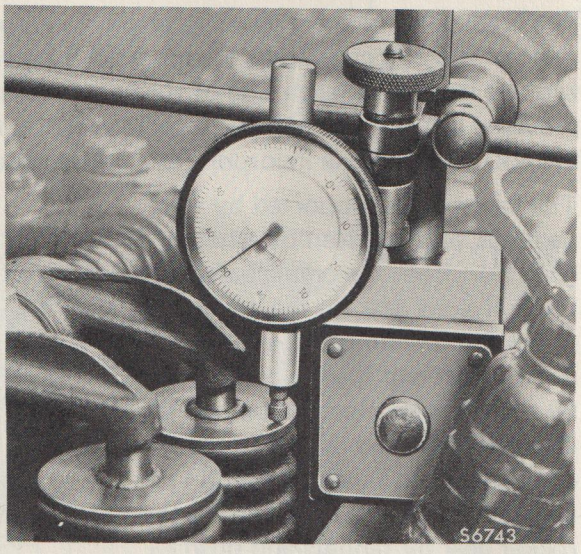


1 VALVE TIMING CHECK

Valve timing can be checked by the following method, without removing the timing cover.

(a) Remove the flywheel underpan and mark the flywheel between the 40th and 41st teeth from the U/C mark, counting in the opposite direction of engine rotation.

(b) Mount a dial gauge over No. 1 intake valve (on some engines it is more convenient to use the intake valve of the rear cylinder) with gauge plunger contacting spring cap.



(c) Turn the engine in the normal direction of rotation until, by observing the gauge, the intake valve is seen to be fully open. At this point, the mark made on the flywheel should coincide with the pointer in the timing aperture in the clutch housing. A discrepancy of 4 to 5 teeth on the flywheel ring gear indicates a one tooth error in the valve timing. A discrepancy of between 1 and 4 teeth indicates excessive gear backlash or wear in the keyways of the crankshaft or crankshaft gear, or of the key itself.

2 VALVE CLEARANCE ADJUSTMENT

Whenever the valve rocker gear is disturbed it will be necessary to make a preliminary setting of the valve clearances before cranking the engine. Turn the engine until the two valves of No. 4 cylinder (four-cylinder engine), or No. 6 cylinder (six-cylinder engine) are in the 'overlap' position, i.e. the exhaust valve about to close and the intake valve just commencing to open.

If the adjustment of the valve clearances has been disturbed there is a possibility of a valve head contacting the top of a piston. The engine should therefore be turned slowly to avoid the risk of damage, and if any doubt exists the rocker adjustment screws should be slackened to give adequate clearance.

Adjust the intake and exhaust valve clearances in the following sequence:

Four-cylinder engine

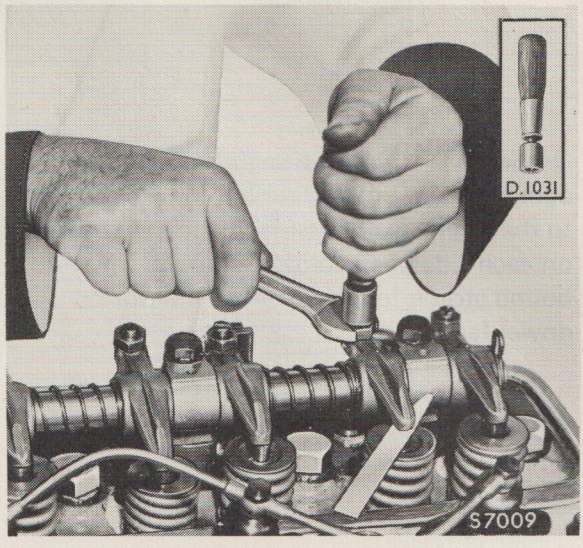
Valve overlap position on:	Adjust valve clearance on:
No. 2 cylinder	No. 3 cylinder
No. 1 cylinder	No. 4 cylinder
No. 3 cylinder	No. 2 cylinder

Six-cylinder engine

Valve overlap position on:	Adjust valve clearance on:
No. 2 cylinder	No. 5 cylinder
No. 4 cylinder	No. 3 cylinder
No. 1 cylinder	No. 6 cylinder
No. 5 cylinder	No. 2 cylinder
No. 3 cylinder	No. 4 cylinder

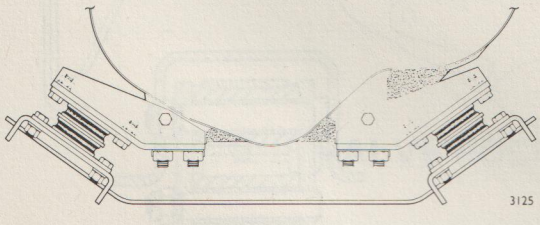
Normal valve clearance adjustment must be carried out with engine idling at operating temperature.

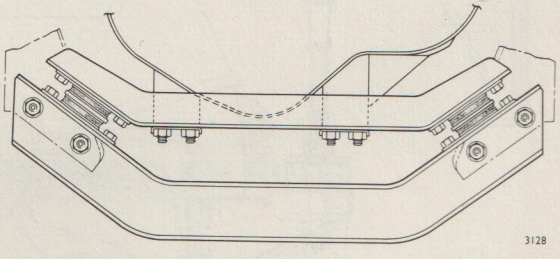
Use Adjuster D1031 to turn adjusting screw.



3 ENGINE FRONT MOUNTINGS

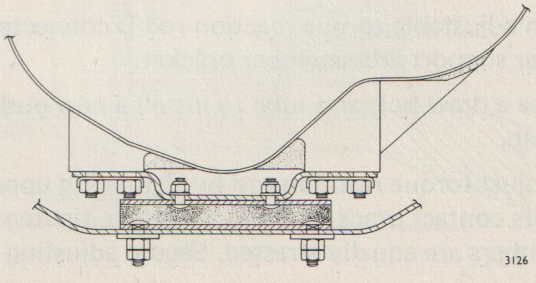
The engine front mounting of the 220 cu in. engine comprise two rubber insulators attached to a bracket or brackets on the timing gear case and the engine front crossmember.





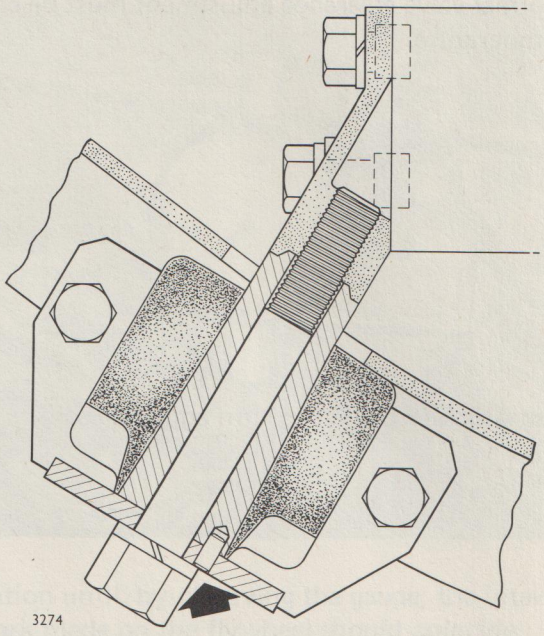
The mountings for Series C and E trucks are shown at left and right respectively.

The single insulator of the 330 cu in. engine mounting is located between a bracket on the timing gear case and the front mounting crossmember.

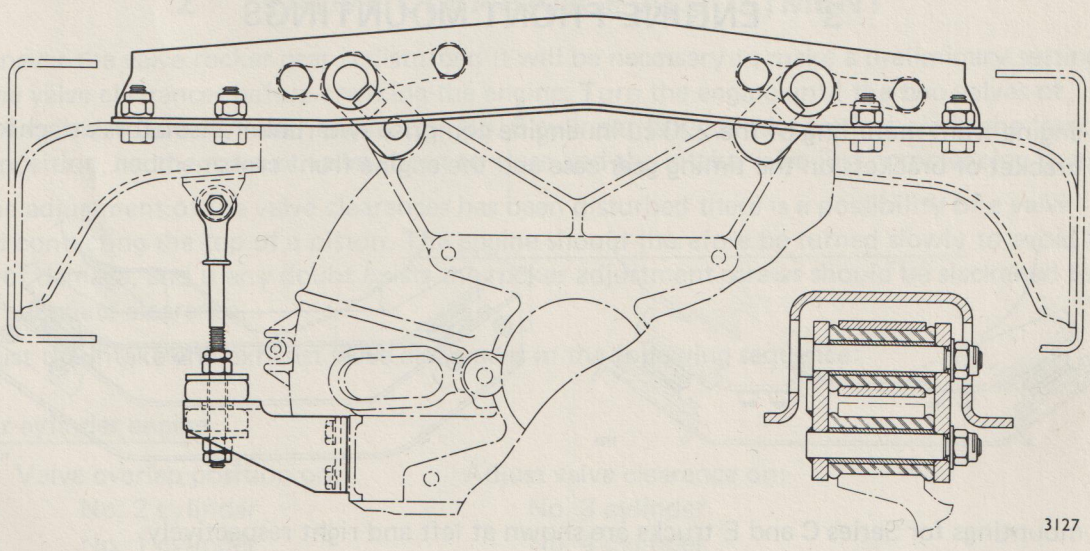


4 ENGINE REAR MOUNTINGS

On Series C trucks the engine rear mountings comprise two bonded rubber blocks attached to the engine rear crossmember and to brackets on each side of the clutch housing. The rebound stop is located in the insulator by a dowel (arrowed).



On Series E trucks the two rear mountings are of the shackle-type. Each shackle is attached to a hanger mounted in the engine rear crossmember and to a lug on the flywheel housing. The flywheel housing and hanger eyes incorporate rubber bushes with an inner sleeve.

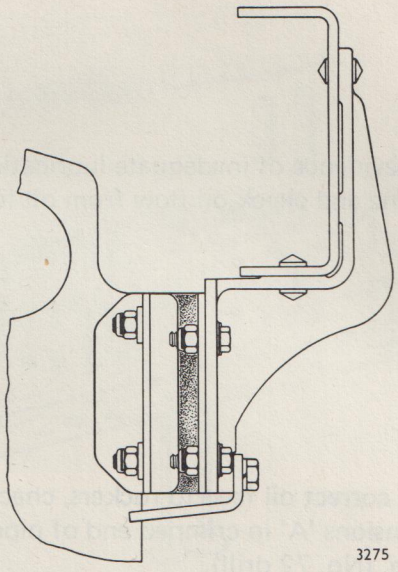


An adjustable torque reaction rod is connected between the flywheel housing and the engine rear support crossmember bracket.

Use a draw bolt and tube to install a new bush after smearing bush and hanger eye with liquid soap.

Adjust torque reaction rod by tightening upper and lower adjusting nuts finger tight until rubbers contact bracket. Using a wrench, tighten adjusting nuts by equal amounts to ensure that rubbers are equally stressed. Secure adjusting nuts in position with the locknuts.

On Series P and N coaches a bonded rubber insulator is sandwiched between the engine support plate and a mounting bracket on both chassis sidemembers. A safety bracket is secured to the mounting brackets as a precaution against insulator failure.



3275

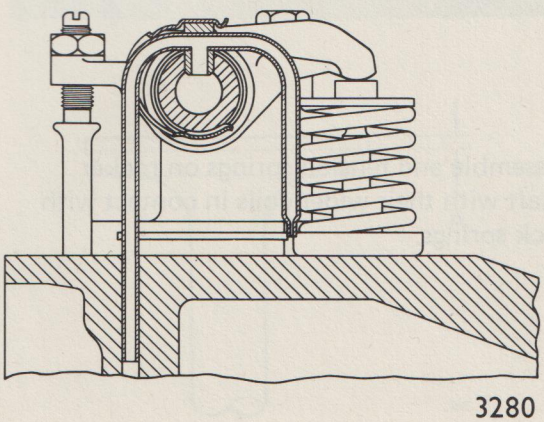
To remove an insulator, support the engine and remove the insulator attachment nuts. Remove the rivets securing the mounting bracket to the sidemember. If both insulators are to be removed it is only necessary to remove one mounting bracket as the engine can be eased to one side to permit the removal of the remaining insulator.

When installing a mounting bracket, clamp bracket to sidemember and align rivet holes with a tapered punch. Drill and ream each hole through bracket and sidemember to closely fit bolt, Part No. 7088583. Secure each bolt with a self-locking nut, Part No. 9906368, and tighten to the specified torque.

Before tightening the mounting bracket bolts, check if a clearance exists between the mounting bracket and insulator. Take up the clearance with shims. If two or more shims are required, they should be assembled in equal numbers to both mountings.

5 VALVE ROCKERS AND PUSH RODS

The rockers are bushed and operate on a single shaft clamped in brackets bolted to the cylinder head. An oil feed pipe is a push fit in a drilling in the cylinder head and the peg of the pipe is secured in the rocker shaft by a spring clip.



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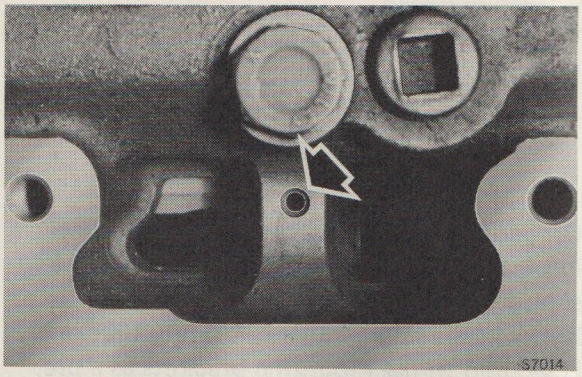
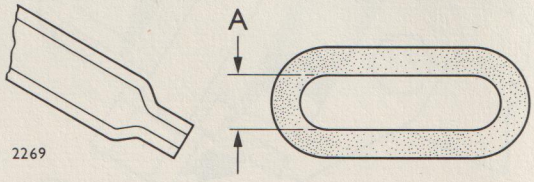
If there is evidence of inadequate lubrication, crank engine and check oil flow from oil feed drilling.



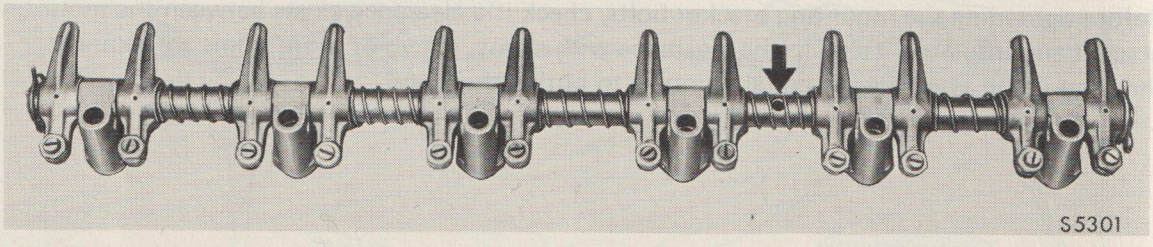
To ensure correct oil feed to rockers, check that dimensions 'A' in crimped end of pipe is 0.025 in. (No. 72 drill).



A single push rod may be removed by ensuring corresponding valve is closed and slackening adjusting screw until it is clear of push rod.

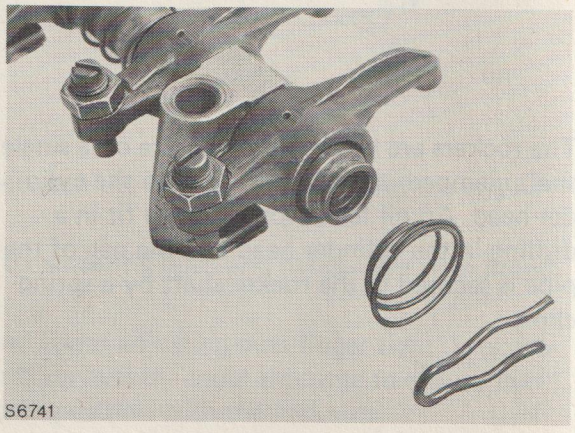
On a 330 cu in. engine in a Series C truck, Nos. 11 and 12 push rods can be removed via hole in scuttle, after removing rubber plug.

Replacement rocker bushes consist of two narrow bushes which should be pressed in from each side of the rocker until the outer ends are flush. The split in each bush should be to top of rocker. After installation bushes should be honed to provide specified clearance with rocker shaft.

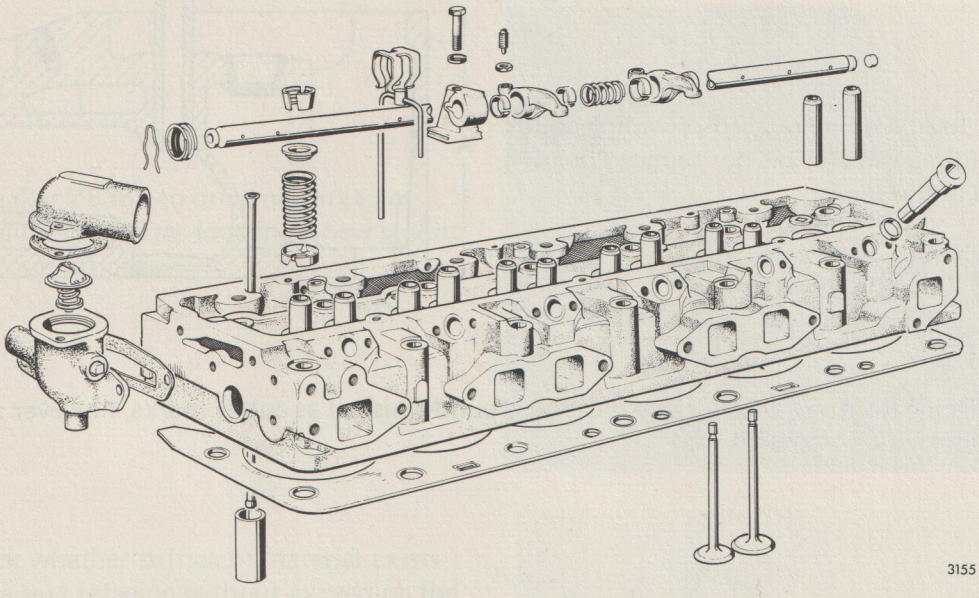


When assembling rockers and brackets to shaft, position shaft oil inlet hole at the top and between Nos. 2 and 3 rockers on a 220 cu in. engine and between Nos. 4 and 5 rockers on a 330 cu in. engine.

Assemble end tension springs on rocker shaft with their wider coils in contact with lock springs.



6 CYLINDER HEAD AND VALVES



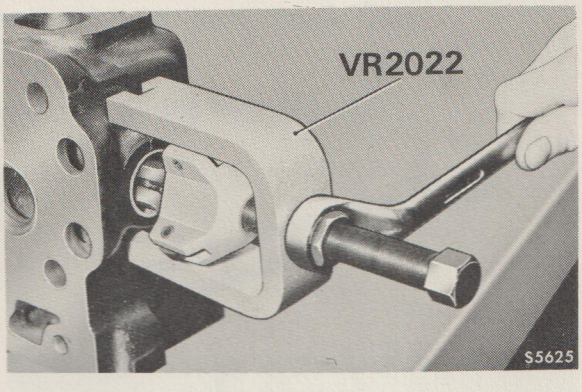
The cylinder head is located by two dowels and is secured to the cylinder block by bolts. The valves operate in renewable guides. The valve rockers operate on a hollow shaft mounted on brackets and are positively lubricated via a drilling in the cylinder block and head. A laminated steel gasket is used.

6a CYLINDER HEAD—Removal and Reconditioning

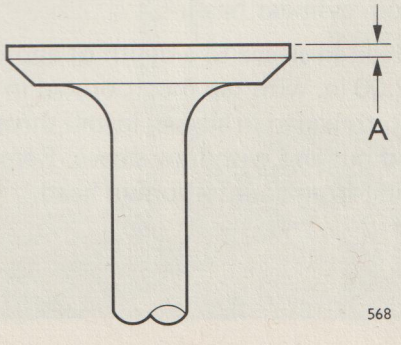
Do not drag cylinder head across locating dowels otherwise head face may be irreparably damaged.

Use Remover VR2022 for withdrawal of cup plug. To facilitate removal, drive plug in slightly to break seal.

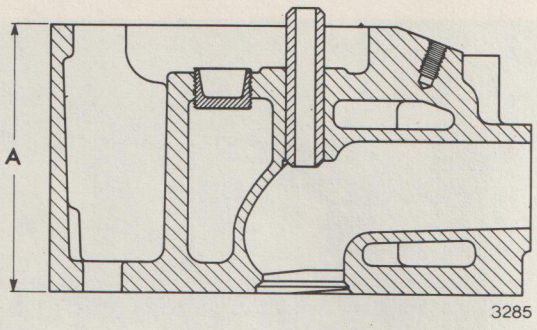
When installing, smear plug with sealing compound.



Renew a valve if thickness of head 'A', after refacing, is below specified minimum.

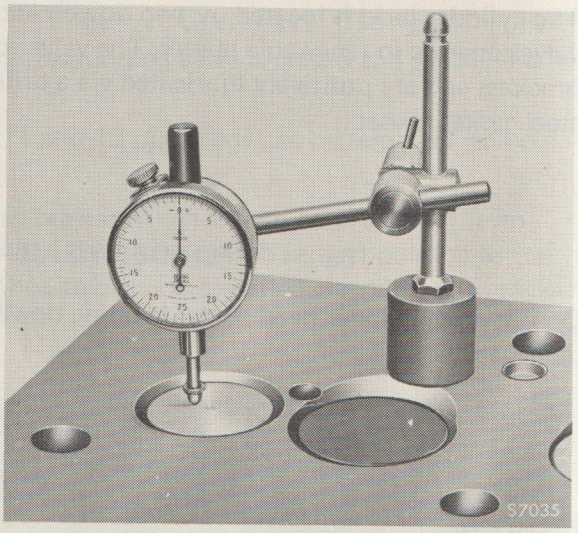


Cylinder head may be refaced providing depth of head (dimension 'A') is not reduced below specified minimum.



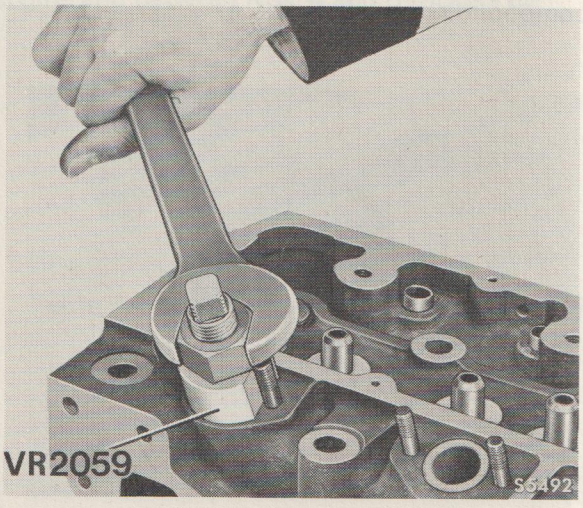
When refacing head, contact surface must be ground-finished as cutter marks, however small, can be detrimental to gasket life.

After refacing cylinder head or installing a new valve check that depth of valve in head is not less than specified minimum. If necessary, increase valve depth by refacing valve or seat.

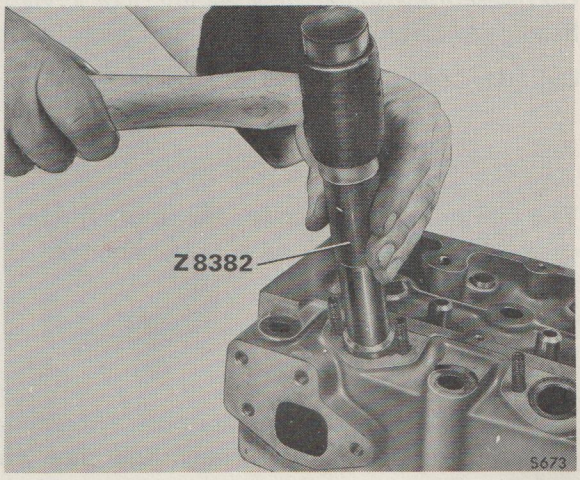


Use Remover VR2059 to extract an injector sleeve from cylinder head.

Cut a thread in sleeve to a depth of approximately 2.00 in. with tap incorporated in tool. Leave tap threaded in sleeve, install thrust block and nut and withdraw sleeve. Remove sealing ring from counterbore in head.

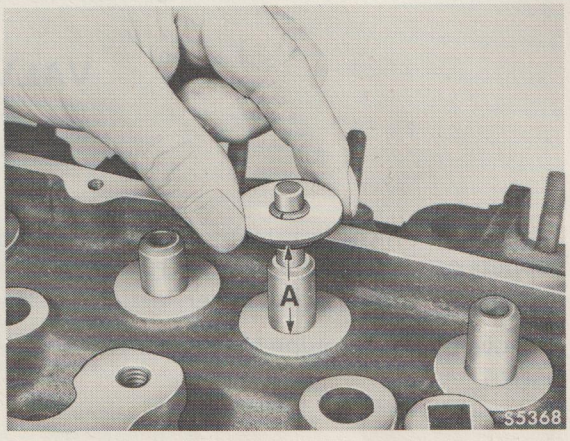


Use Installer Z8382 to drive new injector sleeve fully home after locating a new sealing ring in counterbore.



To check whether sufficient material exists for valve seat refacing without exceeding the specified maximum valve spring assembled height, insert the valve intended to be used in the port being checked and assemble the spring cap and split collars.

Pull valve against seat and check dimension 'A' between underside of cap and cylinder head. If height is less than specified maximum, valve seat refacing is permissible.

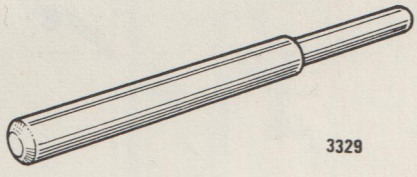


If dimension 'A' exceeds specified maximum, repeat check with a valve seat packing washer Part No. 6345553 (0.062 in. thick) assembled over valve guide. If dimension between washer and cap still exceeds specified maximum, cylinder head is unfit for further service.

It is not permissible to use more than one washer on a valve.

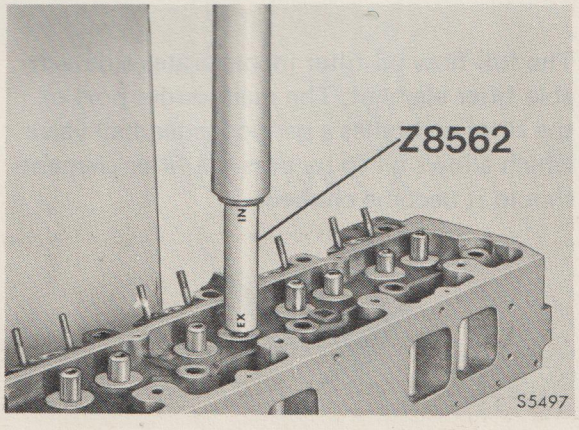
Note position of packing washers which must be installed during head reassembly.

When renewing a valve guide, drive out old guide from cylinder head using Remover Z8378.



Press new valve guide into head to correct depth using Installer Z8562. Installer is double-ended and marked 'IN' and 'EX' for intake and exhaust valve guides respectively.

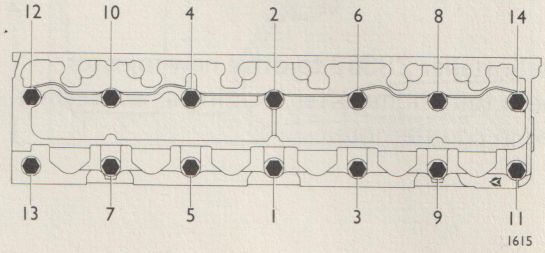
Lubricate valve stems with graphited oil.



On reassembly, locate new sealing rings in water ports at rear of cylinder block. Cylinder head gasket should be installed dry. Lightly lubricate cylinder head bolts with EP gear oil.

Cylinder head bolts must be tightened gradually and evenly to the specified torque.

The tightening sequence for the four-cylinder engine is similar to the six-cylinder engine sequence, shown here.

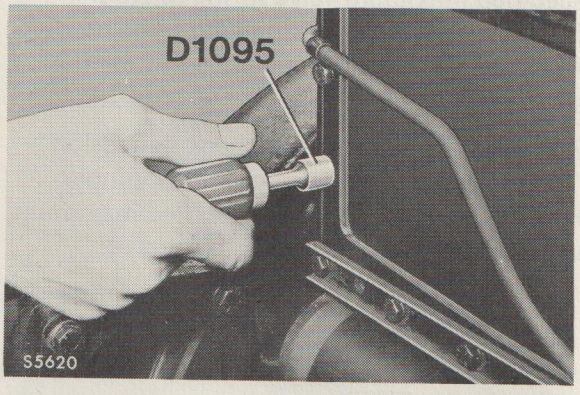


Before connecting hose to thermostat housing, insert two pellets of Vauxhall Stop Leak in hose. Do not introduce pellets through filler pipe where this is connected to the radiator bottom tank as it is possible for pellets to lodge here out of the normal circulation of coolant.

7 VALVE TAPPETS

Tappets can be withdrawn after removing rocker gear and push rod cover.

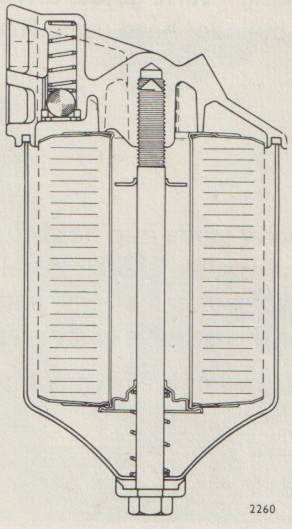
Remove cover attaching bolts with Wrench D1095.



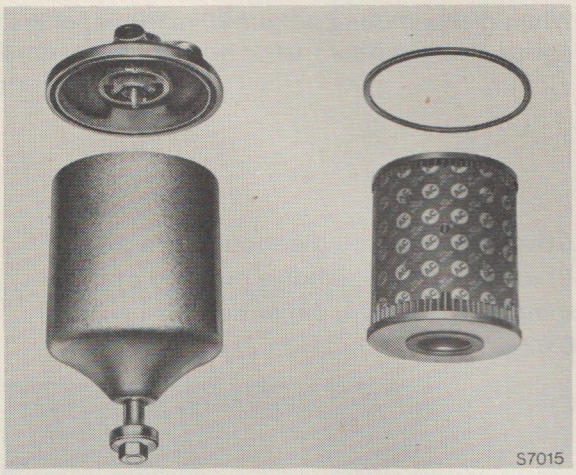
When installing tappets, lubricate with graphited oil to prevent scuffing on initial starting. When installing push rod cover, smear jointing compound on threads of bolts used to secure cover to cylinder head.

8 OIL FILTER

The full-flow oil filter incorporates a detachable filter element. The main outlet port of the filter embodies a spring-loaded ball valve which allows oil to by-pass the filter element should it become choked.



To renew element, unscrew filter casing centre bolt and withdraw casing and element. Do not remove protective sleeve from new element.



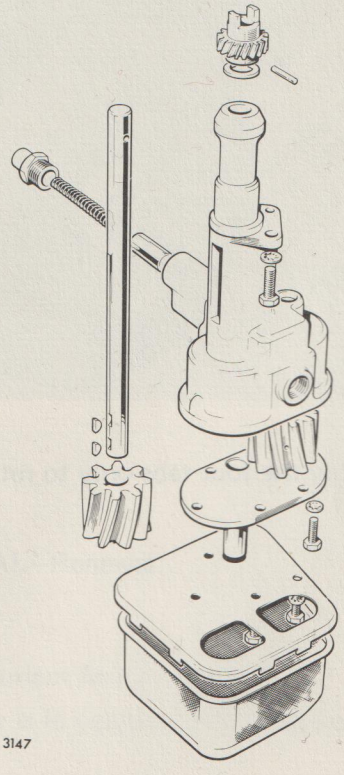
9 OIL PAN

The pressed-steel oil pan is sealed by a one-piece gasket that is manufactured from an asbestos-based material which expands on contact with oil and must be assembled dry.

10 OIL PUMP

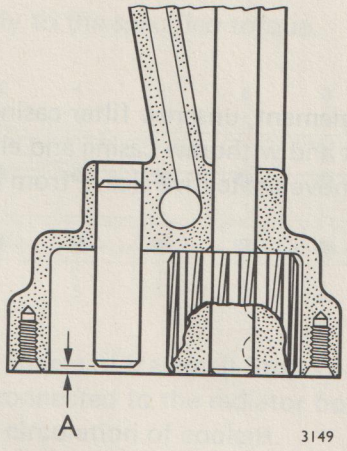
The gear-type oil pump is mounted in the right-hand side of the crankcase. The pump driving spindle is carried direct in the bore of the pump body and has a helical tooth impeller keyed to its lower end. The driving impeller meshes with a driven impeller, which rotates on a spindle in the pump body. A bottom cover bolted to the pump body incorporates a suction pipe and gauze screen.

An oil pressure relief valve is incorporated, and a pipe connects the delivery port to a vertical drilling in the crankcase which leads to the oil filter.



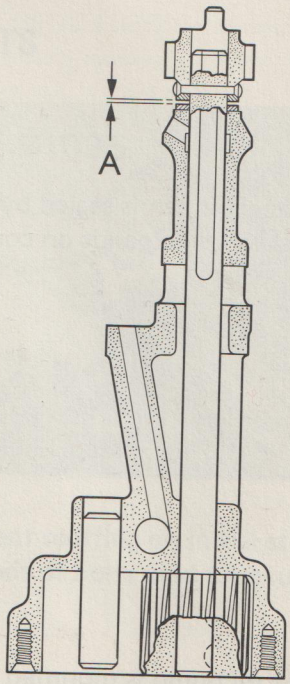
When disassembling oil pump, mark impellers to identify bottom face on reassembly.

Driven impeller spindle should be a press fit in pump body; relative position of this spindle is as shown, dimension 'A' being 0.02 in.



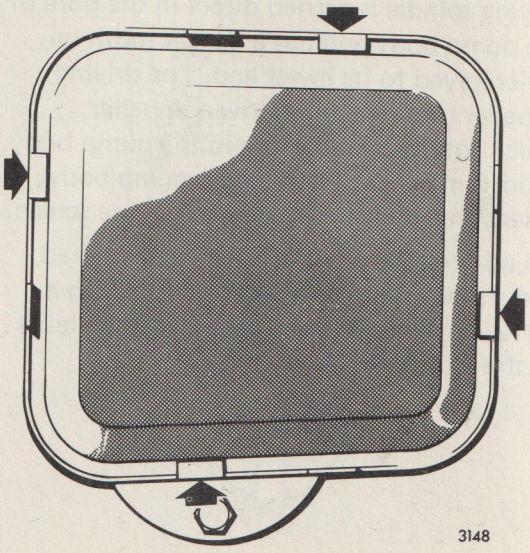
3149

Where a new driving spindle is being installed, press impeller on spindle until end faces are flush. Assemble spindle in pump body and install a new thrust washer. Drill a rivet hole in spindle using a $^{3}/_{16}$ in. diameter drill (drilling must not pierce flat on spindle otherwise rivet will impede flow of oil to spindle). End float (dimension 'A') must be as specified. Lubricate spindle with graphited oil.



3150

On reassembly use four tabs only to retain screen.



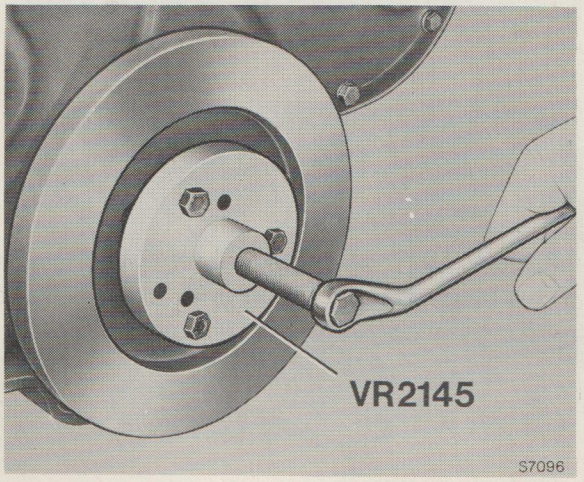
3148

11 CRANKSHAFT PULLEY AND TIMING COVER

The pulley is a keyed interference fit on the crankshaft spigot, and on the six-cylinder engine incorporates a rubber-bonded vibration damper. The timing cover incorporates a spring-loaded lip-type seal in contact with the crankshaft pulley hub.

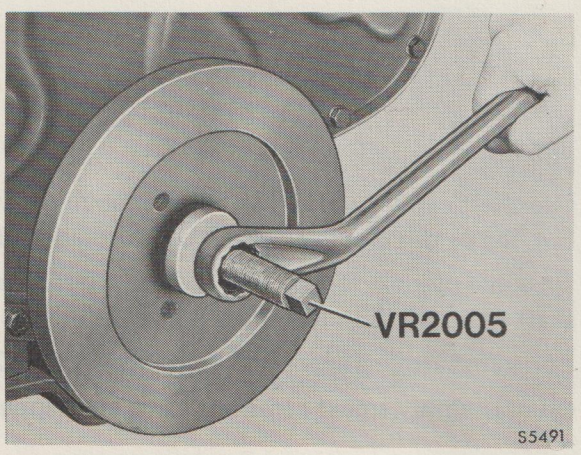
11a CRANKSHAFT PULLEY—Removal and Installation

Use Remover VR2145 to withdraw crankshaft pulley.



Smear lip of seal with recommended lubricant before installing pulley.

Install pulley with Installer VR2005, and tighten pulley bolt to specified torque.



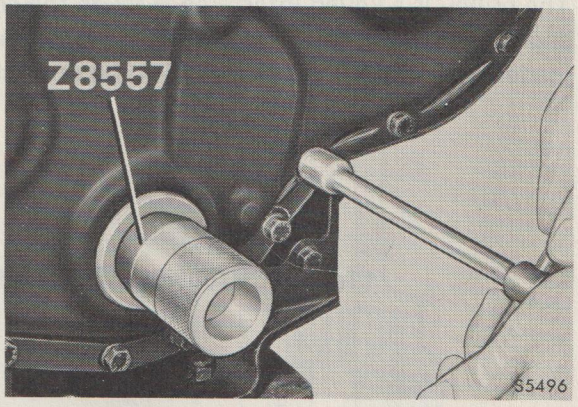
11b TIMING COVER SEAL—Renewal

Timing cover must be removed to renew seal.

Press in new seal, open side first, until seal contacts abutment face in cover.

Before installing cover check that crankshaft oil thrower is in position with concave side facing outwards.

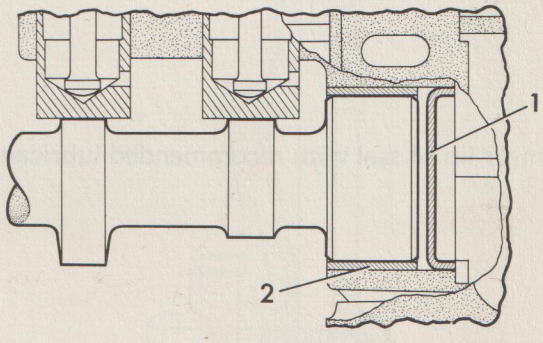
Before tightening cover bolts, locate Aligner Z8557 on crankshaft spigot to engage and align oil seal concentric with pulley land.



12 CAMSHAFT

The camshaft is supported by four bearings in the crankcase and the tappets operate direct in the block. Camshaft end float is controlled by a thrust plate located behind the camshaft gear and bolted to the cylinder block.

The camshaft rear bearing (2) is sealed with a cup plug (1).



Camshaft can be withdrawn after removing drive gear, oil pump, tappets and fuel feed pump. For access to tappets remove push rods and side cover.

On some models, it may be necessary to raise engine slightly to provide clearance for camshaft removal. Withdraw camshaft carefully to avoid damage to bearings in cylinder block.

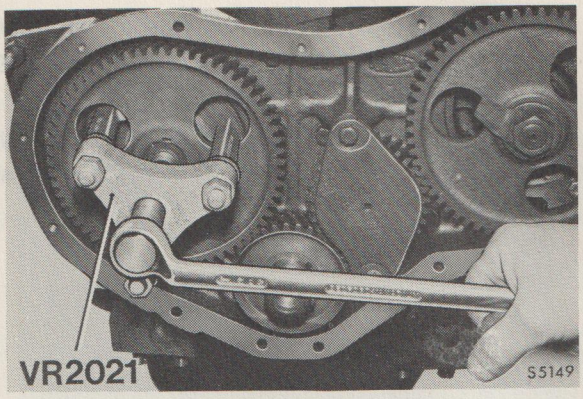
For camshaft bearing renewal,refer to section 20a.

On reassembly,smear camshaft cams and tappets with graphited oil.

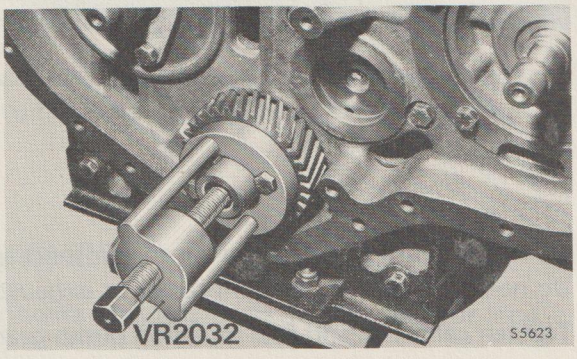
13 TIMING GEARS

The camshaft and fuel injection pump drive gears, which are an interference fit, are keyed to the shafts and secured by nuts and lock plates. The idler gear is bushed and supported on a hub bolted to the timing case and has thrust washers at the front and rear. Lubrication of the timing gears is provided by a jet of oil from the front main bearing and the idler gear hub is separately lubricated from the main gallery, the oil passing through oilways drilled in the hub and crankcase.

Use Remover VR2021 for removing camshaft and fuel injection pump drive gears.

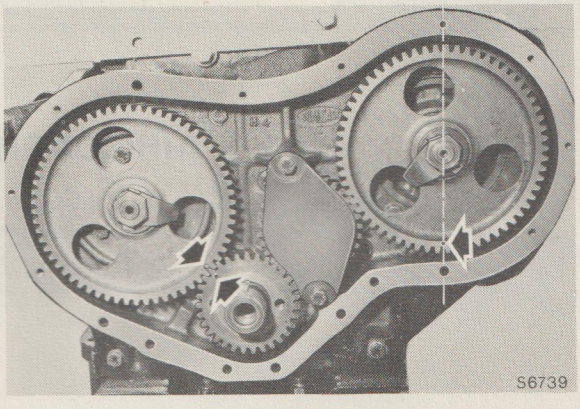


Use Remover VR2032 for removing crankshaft gear.

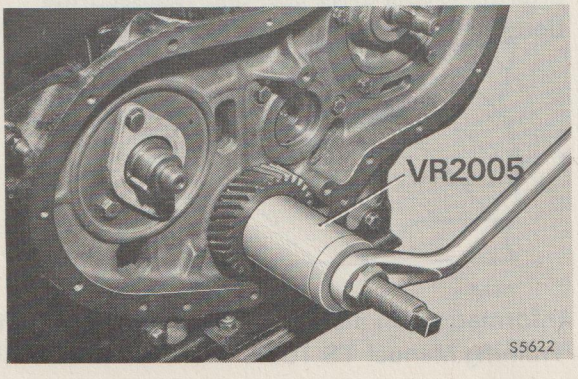


When renewing idler gear bush, ensure that bush does not protrude beyond either face of gear. Service bushes are finished to size.

Install timing gears with marks aligned as shown.



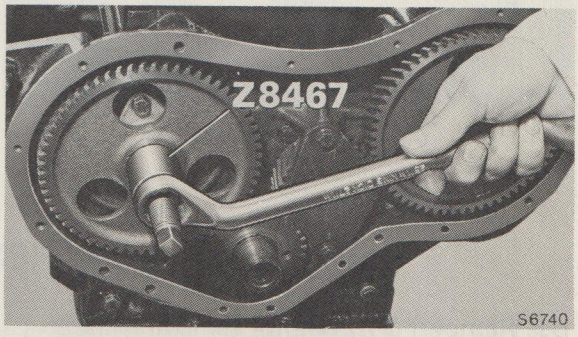
Install crankshaft gear with Installer VR2005.



Assemble idler gear and thrust washers on idler hub with recessed face of gear towards hub flange. Larger diameter washer must locate in gear recess. Install new sealing ring in cylinder block counterbore.

Should it be necessary to rotate the crankshaft with the camshaft gear removed, slacken the rocker adjustment screws. This avoids the possibility of a piston crown contacting a valve head.

Install camshaft and fuel injection pump gears with Installer Z8467.

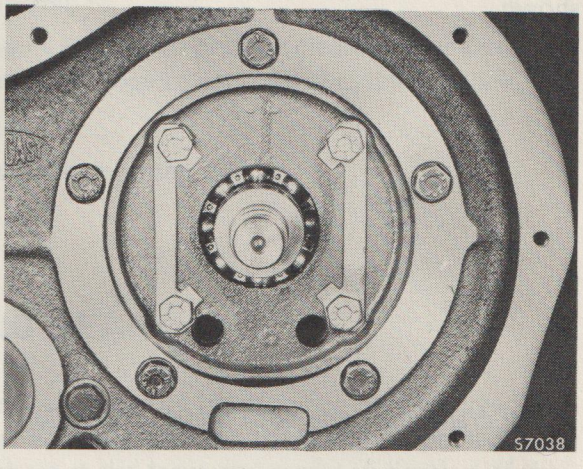


Do not attempt to drive gear on to camshaft as this will disturb camshaft rear bearing plug. Do not drive gear on to compressor or exhauster as this will damage unit.

Tighten camshaft and fuel injection pump gear nuts to specified torque.

14 AIR COMPRESSOR/EXHAUSTER

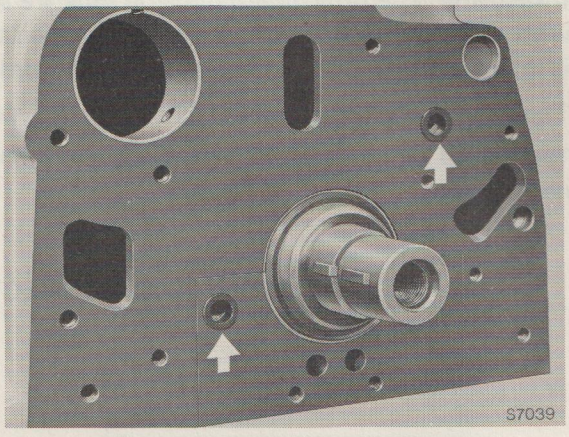
Compressor or exhauster can be removed after removing drive gear and five securing bolts.



Information on disassembling and reassembling the compressor or exhauster is contained in Training Manual TS 1087.

15 TIMING CASE

The timing case, which is located by two dowels, is secured to the crankcase by five bolts in addition to some of the bolts securing the timing case cover. A gasket is interposed between the timing case and crankcase and neoprene rings are located in the counterbore of each oil feed drilling.

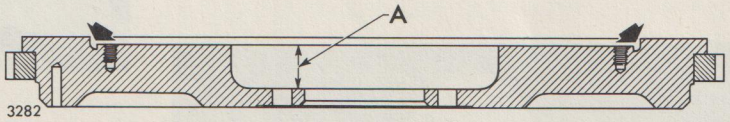


The timing case can be removed leaving compressor or exhauster and fuel injection pump in position supported by a length of wire attached to the exhaust manifold. Do not pass wire around fuel injection pipes.

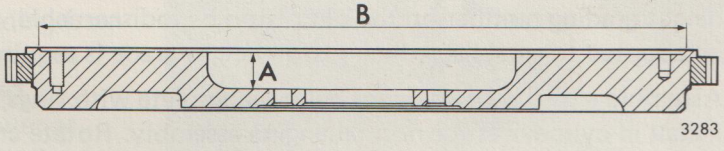
16 FLYWHEEL

The flywheel has a shrunk-on ring gear and two dowels protrude from the rear face for location of the clutch.

When refacing friction face on the 220 cu in. engine, depth of flywheel at 'A' must not be reduced below 0.89 in. After machining friction surface, restore the 0.04 in. deep undercut at the outer edge (arrowed) to avoid a corner radius that may prevent clutch cover from seating.

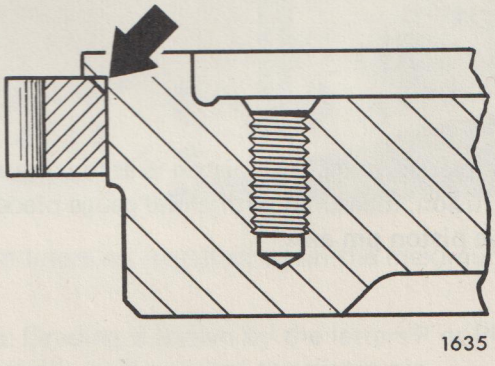


When refacing friction face on the 330 cu in. engine, depth of flywheel at 'A' must not be reduced below 0.80 in. Diameter of machined surface (dimension 'B') must be 15.30 in. minimum to accept clutch cover.



Friction face should be ground finished.

When installing a new ring gear, expand by heating to a temperature of 320°C (dark blue colour) and install gear with chamfered inner face towards flywheel flange.



Flywheel bolts must be tightened evenly to specified torque.

17 PISTONS AND CONNECTING RODS

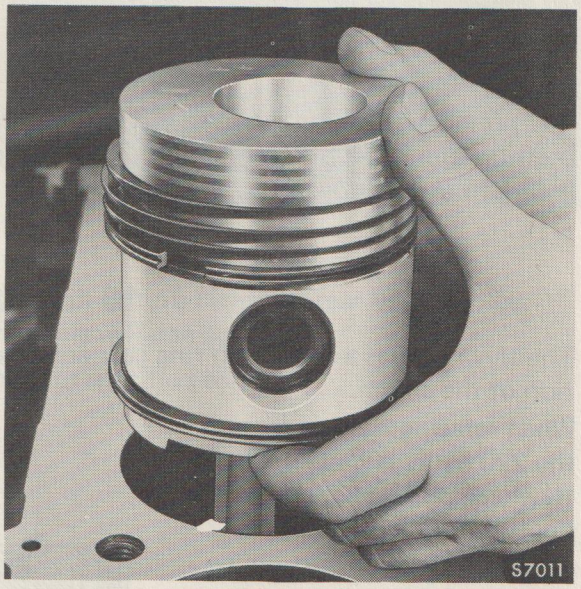
The pistons are of aluminium alloy with a toroidal combustion chamber offset away from the thrust side. The fully-floating piston pins are retained by circlips and the pistons are provided with three compression rings and two slotted type scraper rings. The outer face of the top ring is inlaid with chromium. The second and third rings are internally stepped.

The connecting rods have detachable shell-type bearings with caps secured with nuts and bolts.

The piston pin bush is of lead-bronze and lubricated through a drilling in the top of the connecting rod.

17a PISTONS AND CONNECTING RODS—Removal and Inspection

Piston and connecting rod must be withdrawn through top of cylinder block.

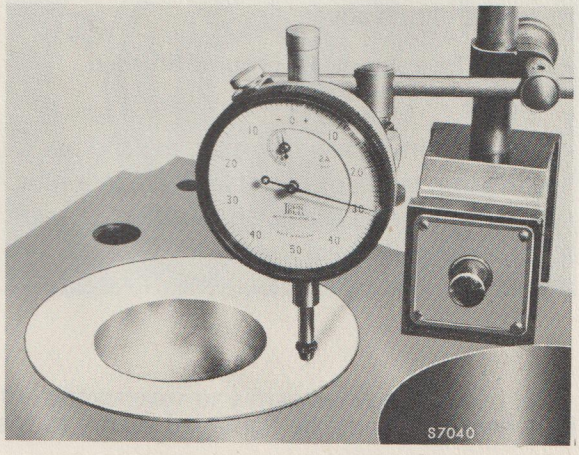


Three piston height grades are available for selection to attain the specified piston protrusion above the cylinder block face. These are identified by the numbers 1, 2 and 3 stamped on the piston crown for +0.005 in., standard and −0.005 in., respectively.

When renewing a piston, replace old with a piston of the same height grading. Should the height grading number on the old piston be indiscernable, the following procedure should be adopted to establish which piston height grade is required.

Assemble a piston of standard height, complete with rings, on to the connecting rod and install in cylinder as for normal engine assembly. Rotate crankshaft three turns to centre piston in bore.

Rotate crankshaft until piston is at maximum protrusion, measured with a dial gauge placed above piston pin axis.

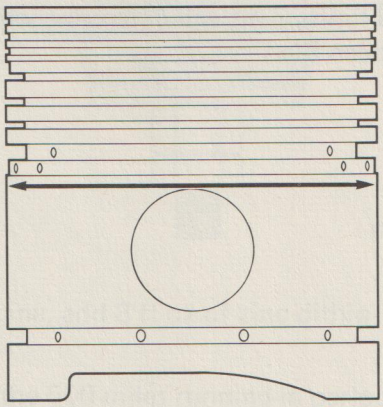


If the protrusion is within the specified limits the standard height piston is correct. A protrusion below limits indicates that a +0.005 in. height piston is required and a protrusion above limits indicates the need for a −0.005 in. height piston.

Installation of a new or rebushed connecting rod may effect piston protrusion which should be measured as previously described.

When assessing piston to bore clearance, and when reboring, maximum accuracy in piston and bore measurement is essential.

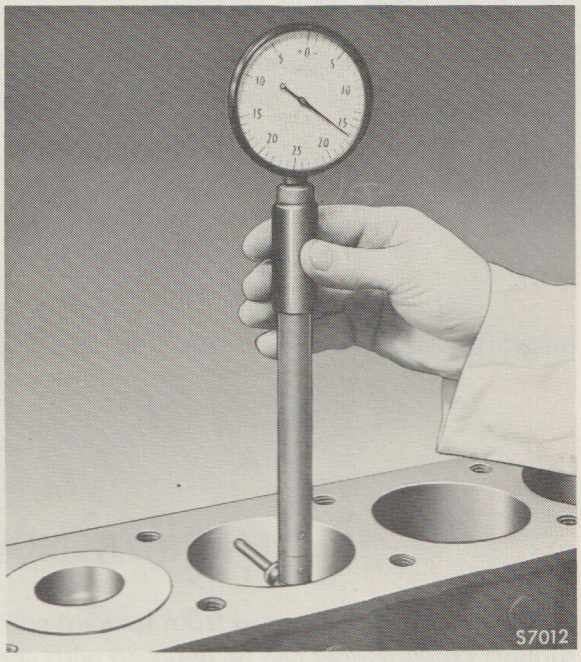
As piston skirt is ground both oval and tapered, it is imperative that piston size is measured only at right-angles to piston pin and 2.00 in. from piston crown.



3133

Micrometer spindle must turn freely so that it can be adjusted up to piston with a very light turning effort. If micrometer is adjusted to get a frictional feel over piston, it will indicate a dimension significantly smaller than the actual size.

When checking cylinder bores it is not sufficiently accurate to take a direct reading from an inside micrometer. For maximum accuracy, a cylinder gauge should be used, in conjunction with the same micrometer as used for measuring piston. By this method, any discrepancy between individual micrometers is avoided.



S7012

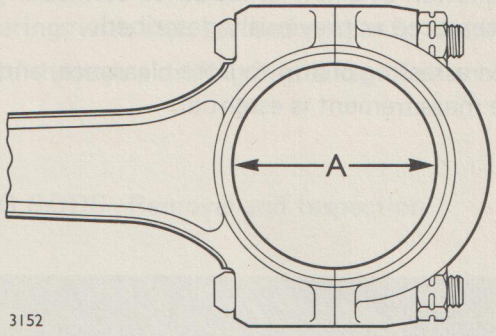
Maximum piston oversize is 0.040 in., except when liners are installed, when the maximum is 0.020 in.

Pistons and pins are serviced as selected assemblies. Grading is shown by the letters P or PP on piston crown which correspond with I or II respectively on the end of the piston pin.

For information on cylinder bore refinishing, refer to Section 20a.

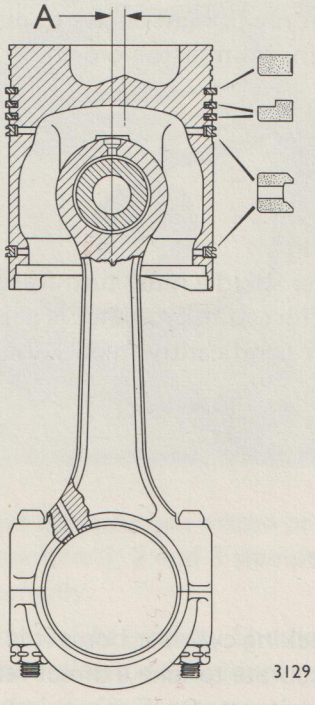
Before installing new piston rings in a worn bore, remove oil glaze with a brush-type de-glazer. This will facilitate bedding-in of rings.

Before assembling rod to piston, check that diameter 'A' of bearing housing bore is within specified limits. This will determine whether cap has been filed.



3152

Correct assembly of piston rings is as shown. Note that offset 'A' of combustion chamber is away from oil bleed hole side of rod. Ring gaps must be equally spaced around piston.



3129

Install pistons so that combustion chamber is offset away from camshaft.

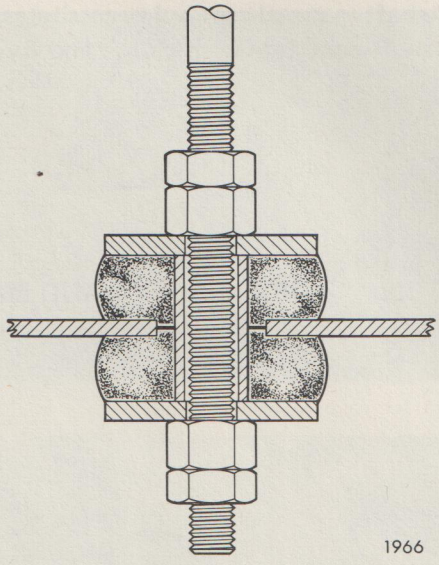
18 ENGINE REMOVAL AND INSTALLATION

To facilitate engine removal from forward control trucks, cab should be removed. Engine rear support crossmember can be removed with engine.

When it is not practical to remove cab, as in the case of an integral cab and body, it will be necessary to remove front axle and lower engine through chassis, leaving rear support crossmember in position on chassis.

On coaches, chassis frame front crossmember is detachable, permitting engine to be withdrawn through front of vehicle.

Adjust torque reaction rod by tightening upper and lower adjusting nuts finger tight until rubbers contact bracket. Using a wrench, tighten adjusting nuts by equal amounts to ensure that rubbers are equally stressed. Secure adjusting nuts in position with the lock nuts.



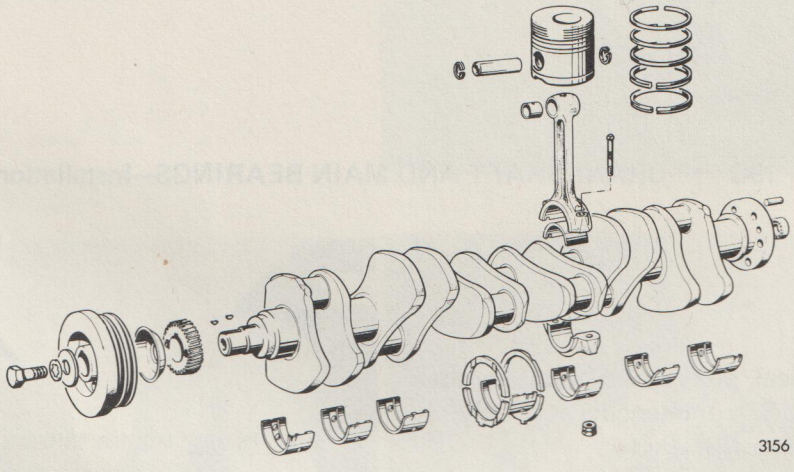
1966

When filling the oil pan of a short motor or rebored engine, add 8 fl oz of zinc dithiophosphate additive as a running-in compound.

It is essential that the additive is used only throughout the 500 miles running-in period, and, should the oil be changed before 500 miles have been accomplished, additive should be added to the fresh oil.

19 CRANKSHAFT, MAIN BEARINGS AND REAR SEAL

The crankshaft of the 220 cu in. engine is supported by five main bearings and the crankshaft of the 330 cu in. engine is supported by seven. End float is controlled by thrust washers located each side of the centre bearing.



3156

A two-piece braided-fabric type seal contacts the crankshaft at the rear and a spring-loaded lip-type seal in the timing case cover contacts the crankshaft pulley hub. Oil seal corks are installed between the joint faces of the front and rear main bearing caps and the crankcase. In service, felt seals are used.

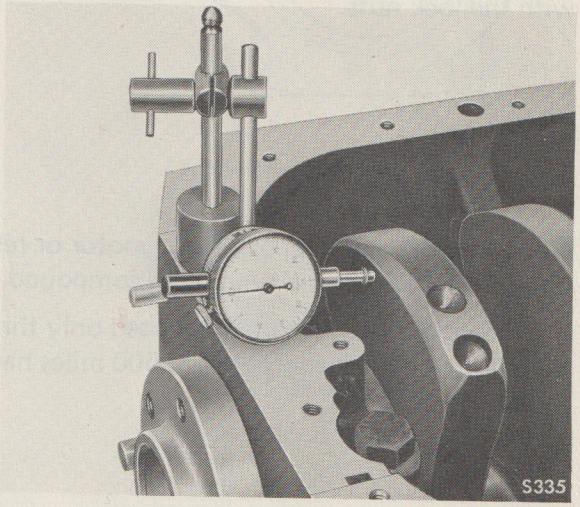
Two dowels in the rear flange locate the flywheel.

19a CRANKSHAFT REAR SEAL--Renewal

Crankshaft rear seal renewal necessitates engine removal. To gain access to seal, withdraw crankshaft complete with clutch and flywheel, leaving pistons and connecting rods in cylinder bores.

19b CRANKSHAFT AND MAIN BEARINGS--Removal and Reconditioning

Before removing crankshaft during engine overhaul, check end float to determine if thrust washers on centre bearing are worn. Oversize thrust washers are serviced.

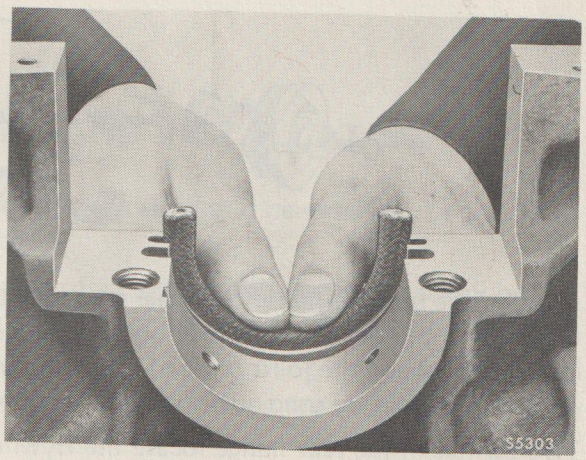


It is permissible to regrind crankshaft to 0.020 in. undersize. After regrinding, main journal and crankpin fillets must be re-rolled to specified radius to ensure maximum resistance to fatigue. Whenever a crankshaft is reground or a replacement crankshaft installed it will be necessary to check piston protrusion above the cylinder block face as detailed in Section 17.

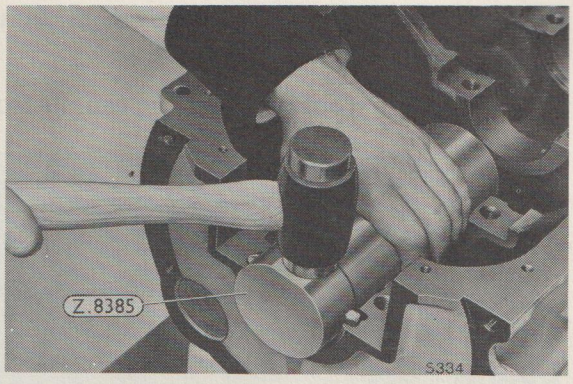
19C CRANKSHAFT AND MAIN BEARINGS--Installation

To renew rear seal, press seal strip into groove in crankcase block, commencing at the centre and working towards the sides.

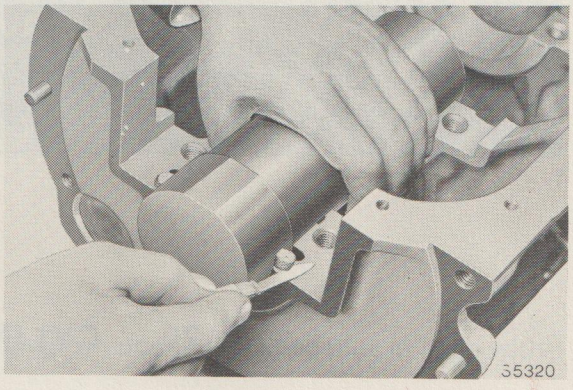
Ensure that both ends of seal project above bearing cap locating face.



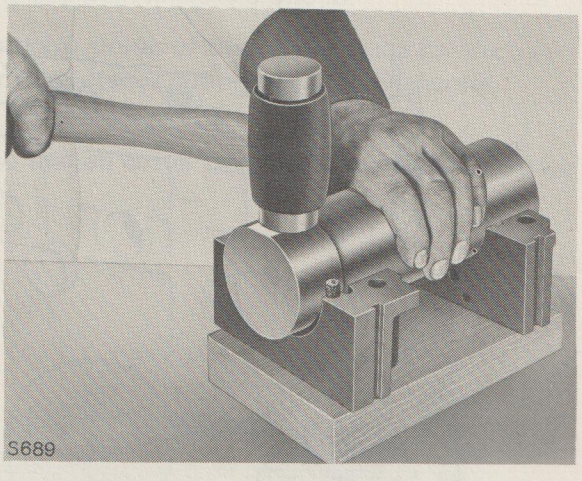
Place Installer Z8385 in position so that larger end is on seal and other end rests in adjacent main bearing housing. Drive seal into position by hammering on flat of installer, and simultaneously applying a semi-rotary movement until installer is felt to bottom.



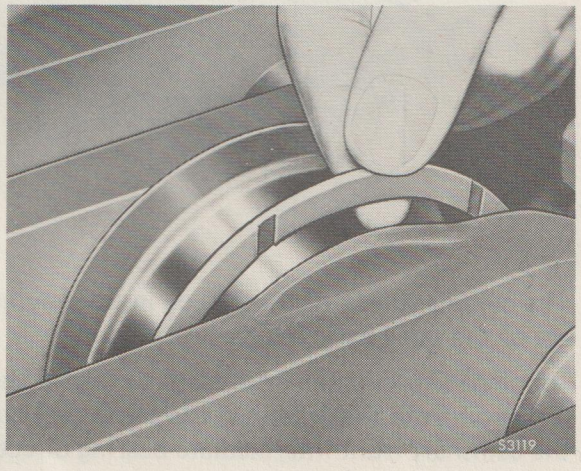
With installer held firmly in position, and using a sharp knife, cut off projecting ends of seal flush with bearing cap locating face. Do not leave frayed ends to become trapped beneath bearing cap. Smear seal liberally with recommended lubricant.



Install seal strip in bearing cap in a similar manner, using front bearing cap as a guide for seal installer. Rest caps on a flat surface to ensure uniform height.



Crankshaft thrust washer oil grooves must face crankshaft thrust faces.

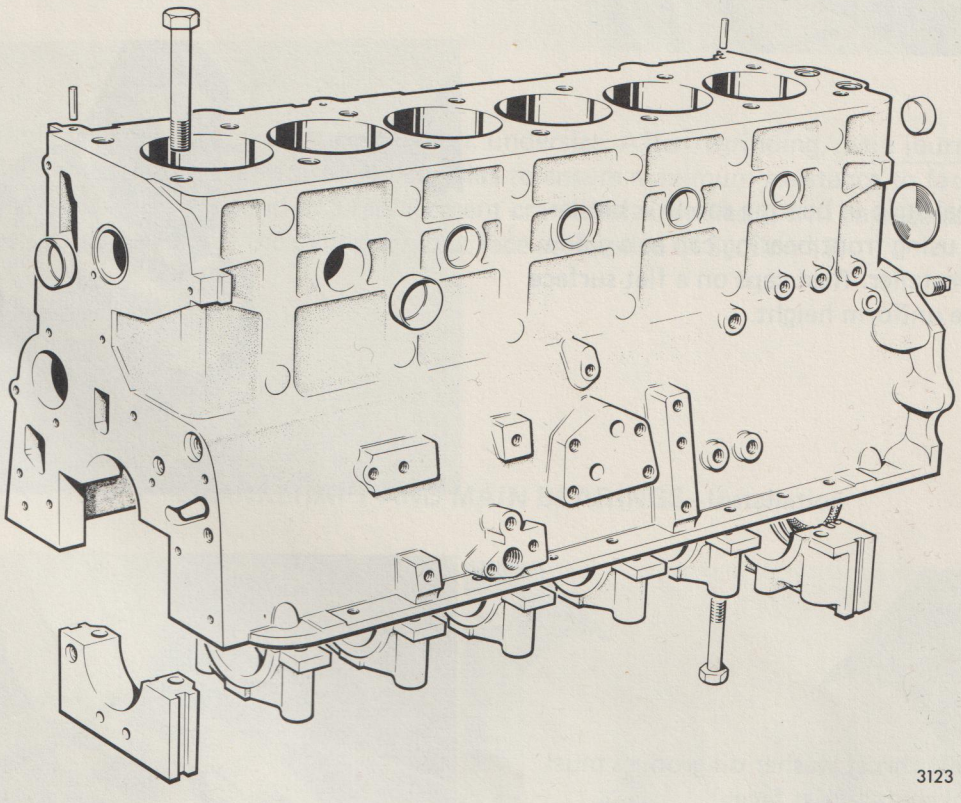


When installing rear main bearing cap, smear mating faces of cap and crankcase with Wellseal jointing compound.

When installing front main bearing cap, its front face must be in alignment with front face of crankcase.

When installing front and rear main bearing cap seals, coat first piece of felt with jointing compound and drive home this and subsequent felts with Installer VR2027. Approximately six felts are required for each groove. Ensure that felts are tightly packed, and leave about 0.010 in. of felt projecting above cap face for compression when oil pan is installed.

20 CYLINDER BLOCK



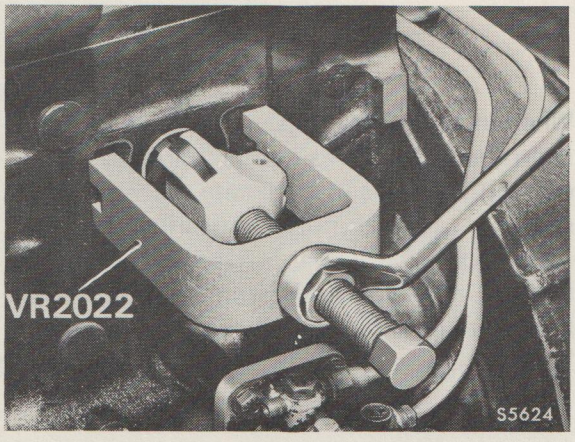
The cylinder block of the 220 cu in. four-cylinder engine and the 330 cu in. six-cylinder engine are of the same basic design.

An oil gallery extends from front to rear of the cylinder block and is sealed by plugs. Oilways direct oil from the gallery to the crankshaft and camshaft bearings and a vertical drilling above the camshaft front intermediate bearing directs oil to the rocker gear.

20a CYLINDER BLOCK—Reconditioning

Refacing of the cylinder block top face is not permissible.

Cup plugs may be withdrawn with Remover VR2022. To facilitate removal, drive plug slightly inwards to break seal.



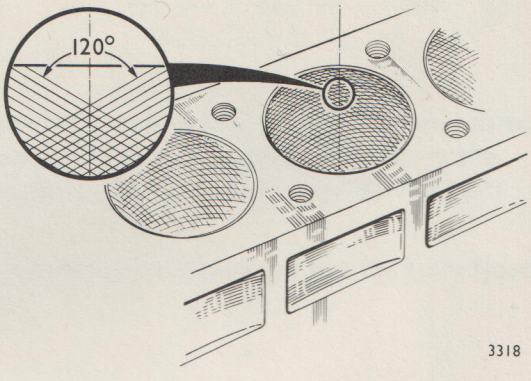
When installing, smear periphery of plug with jointing compound and drive plug in flush with cylinder block face.

Cylinder liners are available. Maximum piston oversize with liners is 0.020 in.

Cylinder bores must be hone finished, with clean sharp stones of the proper grade for the required amount of metal to be removed. Dull or dirty stones cut unevenly and generate excessive heat.

When making initial cuts, leave sufficient metal so that all cutter or coarse stone marks may be removed with the fine stones used for finishing.

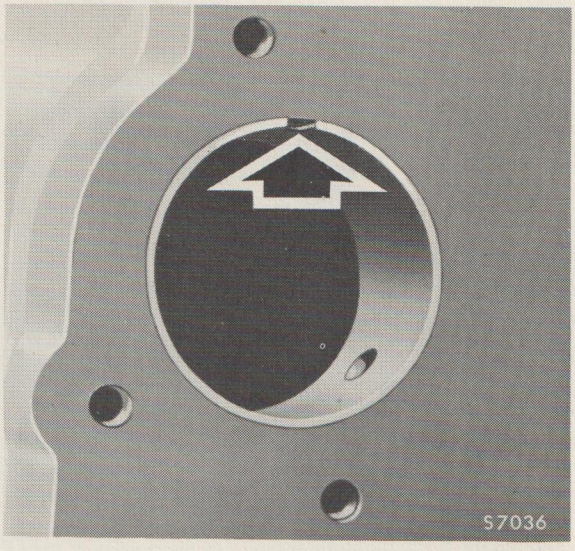
When finish honing, pass hone through entire length of cylinder at a rate that will produce a cross hatch pattern of 30° to the horizontal (120° including angle to axis of bore). This will ensure maximum ring life and minimum oil consumption. Select finishing stones of a grade to produce a surface finish of 15—35 micro-inches.



It is of greatest importance that refinished cylinder bores do not exceed 0.0005 in. out-of-round or taper.

Camshaft rear bearing cup plug will be driven out during bearing removal.

When installing bearings, work in succession from the rear and ensure that oil holes coincide with oilways in crankcase. Each bearing should locate with notch in bearing uppermost and facing forward. Rear bearing should be flush with front of bearing housing. Front bearing must not project beyond crankcase front face.



Replacement bearings are pre-finished to size and must be installed in sets to ensure bearing alignment.

Before installing rear bearing cup plug, apply Loctite Grade AVV to periphery of plug for additional retention and sealing.

466 cu in. DIESEL ENGINE

VALVE TIMING CHECK 55

VALVE CLEARANCE ADJUSTMENT 56

ENGINE MOUNTINGS 57

VALVE ROCKERS AND PUSH RODS 58

CYLINDER HEAD AND VALVES 59

OIL FILTER 63

OIL PAN 63

CRANKSHAFT PULLEY AND TIMING CASE 63

CAMSHAFT 64

TIMING GEARS 65

OIL PUMP 68

AIR COMPRESSOR 70

CRANKCASE FRONT PLATE 71

FLYWHEEL 71

PISTONS AND CONNECTING RODS 72

ENGINE REMOVAL AND INSTALLATION 74

CRANKSHAFT, MAIN BEARINGS AND REAR SEAL 75

CYLINDER BLOCK 78

The 466 cu in. diesel engine has a nominal bore and stroke of 4.562 in. and 4.75 in. respectively. Three variants are produced to suit particular vehicle application, these being the 466–136 (C) coach engine, the 466–116 (P) derated truck engine and the 466–133 (R) truck engine.

The solid-skirt pistons incorporate offset toroidal combustion chambers and the fully-floating piston pins are retained by circlips.

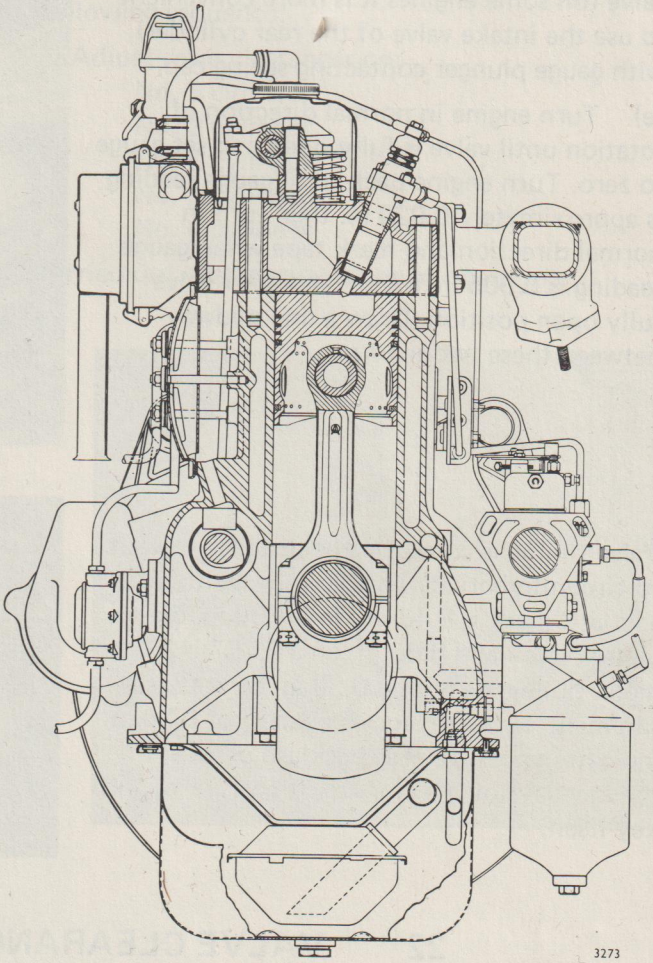
3272

The crankshaft is carried in seven main bearings and shaft end float is controlled by thrust washers on each side of the centre bearing. A spring-loaded lip-type oil seal is provided at the front end and a braided-fabric type seal at the rear.

The camshaft is supported by four bearings and is driven by a helical gear train from the crankshaft. Shaft end float is controlled by a thrust plate bolted to the cylinder block. The valves, carried direct in bores in the cylinder head, are operated via the rocker gear by tappets and push rods.

The internal-rotor type oil pump is mounted in the crankcase and is driven from the crankshaft timing gear through an idler gear. Oil is fed via a full-flow oil filter to the main oil gallery and through drillings in the cylinder block to the crankshaft and camshaft. Lubrication of the timing gears is via a drilling through the idler gear. The rockers are lubricated via an oil feed pipe located in a cylinder head drilling which corresponds with an oil drilling in the cylinder block.

Provision is made for a tachometer drive unit to be mounted on the timing case, the compressor drive gear securing nut being slotted to accept the blade of the tachometer drive unit shaft.



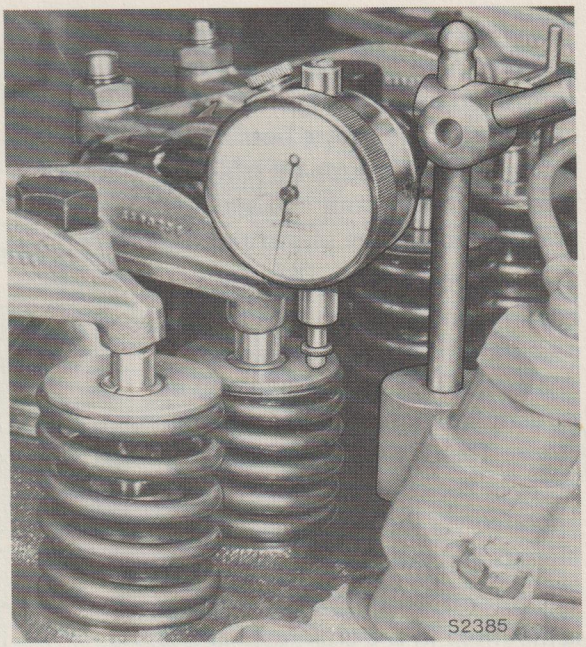
21 VALVE TIMING CHECK

Valve timing can be checked by the following method, without removing timing case.

(a) Turn engine until U/C mark on flywheel coincides with timing pointer on flywheel housing and No. 1 cylinder valves are closed.

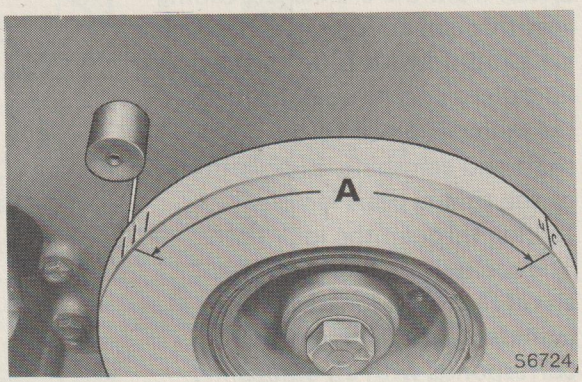
(b) Mount a pointer on timing case adjacent to rim of crankshaft damper (a magnet can be used to secure pointer).

(c) Mark U/C adjacent to pointer on a piece of masking tape attached to periphery of crankshaft damper.



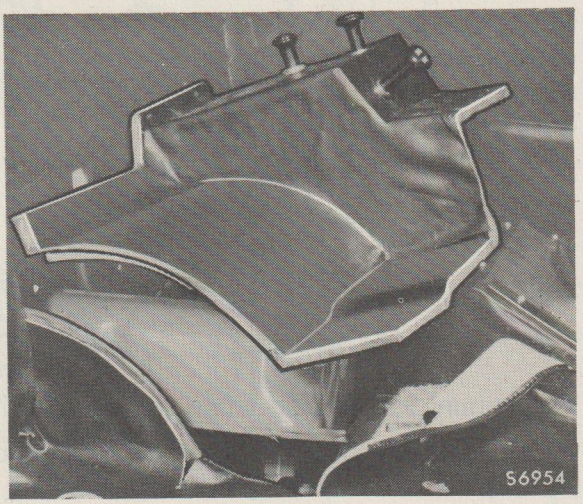
(d) Mount a dial gauge over No. 1 intake valve (on some engines it is more convenient to use the intake valve of the rear cylinder) with gauge plunger contacting spring cap.

(e) Turn engine in normal direction of rotation until valve is fully open and set gauge to zero. Turn engine back until gauge reading is approximately 0.020 in. then turn in normal direction and mark tape when gauge reading is 0.005 in. before and after valve fully open position. Draw a line midway between these two marks.



Valve timing is correct if the distance measured circumferentially between the centre line and U/C mark is 8.48 in. on a 9.00 in. diameter pulley and 8.66 in. on a 9.187 in. diameter pulley, or within 0.30 in. of the measurement. A discrepancy in excess of 0.30 in. indicates excessive gear backlash or wear in the keyways of the crankshaft gear, or of the key itself.

22 VALVE CLEARANCE ADJUSTMENT



To permit rocker cover removal on Series E and HRX trucks, partially remove cab centre panel complete with stop and idle controls.

On vehicles with a double passenger seat, access to the centre panel is only possible after removal of the seat.

Whenever the valve rocker gear is disturbed it will be necessary to make a preliminary setting of the valve clearances before cranking the engine.

Turn the engine until the valves of No. 6 cylinder are in the 'overlap' position, i.e. the exhaust valve about to close and the intake valve just commencing to open.

If the adjustment of the valve clearances has been disturbed there is a possibility of a valve head contacting the top of a piston. The engine should therefore be turned slowly to avoid the risk of damage, and if any doubt exists the rocker adjustment screws should be slackened to give adequate clearance.

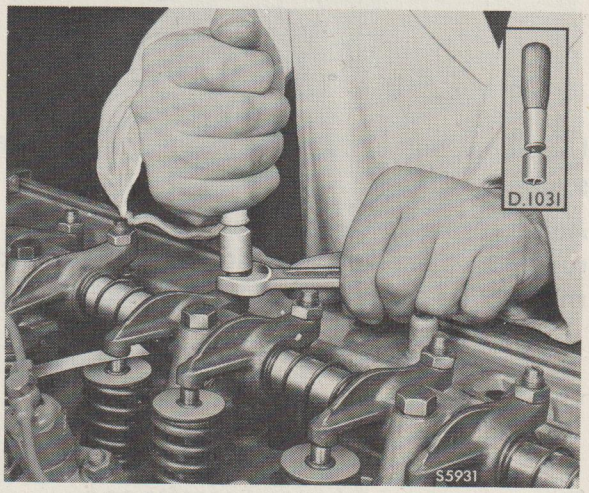
Adjust the intake and exhaust valve clearances of No. 1 cylinder.

Check the remaining valve clearances in the following sequence:

Valve overlap position on:	Adjust valve clearances on:
No. 2 cylinder	No. 5 cylinder
No. 4 cylinder	No. 3 cylinder
No. 1 cylinder	No. 6 cylinder
No. 5 cylinder	No. 2 cylinder
No. 3 cylinder	No. 4 cylinder

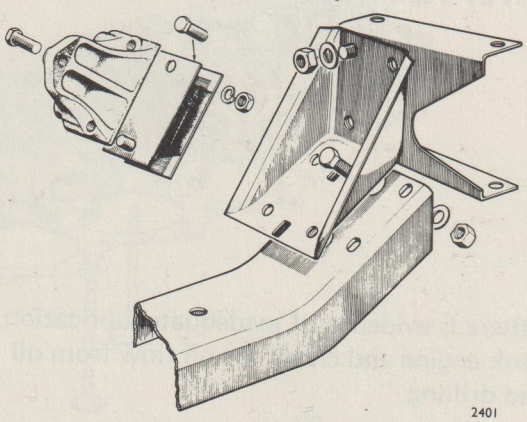
Normal valve clearance adjustment must be carried out with engine idling at operating temperature.

Use Adjuster D1031 to turn adjusting screw.



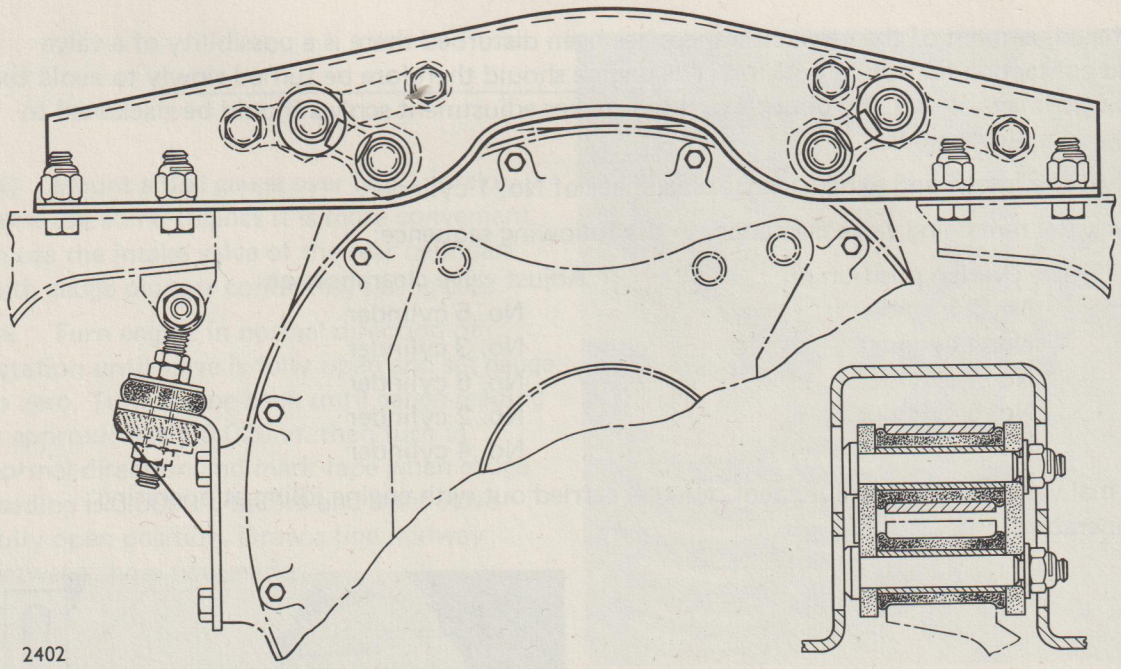
23 ENGINE MOUNTINGS

The engine front mountings comprise two bonded-rubber blocks attached to the crankcase front plate and the engine front crossmember brackets.



The two rear mountings are of the shackle-type. Each shackle is attached to a hanger mounted in the rear mounting crossmember and to a lug on the flywheel housing. The flywheel housing and hanger eyes contain rubber bushes with an inner sleeve.

An adjustable torque reaction rod is connected between the flywheel housing and the engine rear support crossmember bracket.

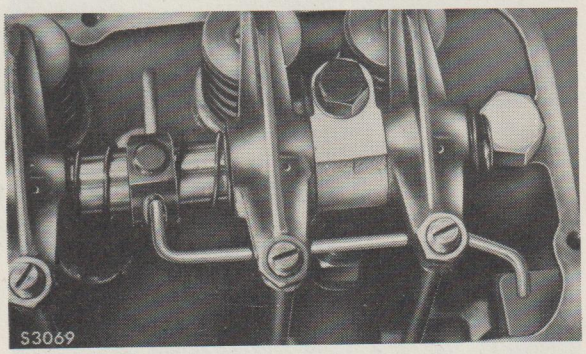


Use a draw bolt and tube to install a new bush after smearing bush and hanger eye with liquid soap.

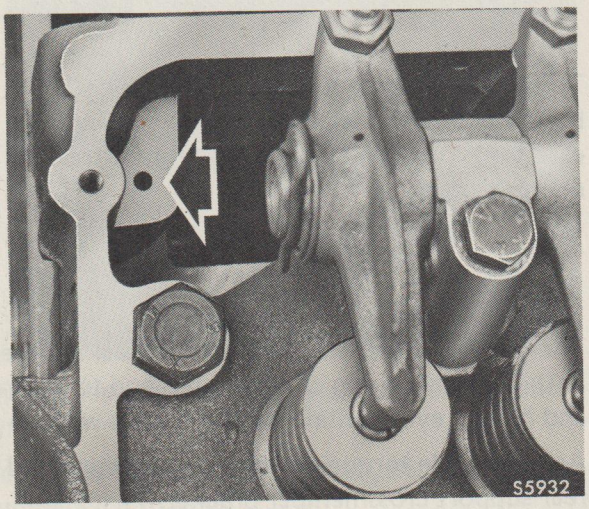
Adjust torque reaction rod by tightening upper and lower adjusting nuts finger tight until rubbers contact bracket. Using a wrench, tighten adjusting nuts by equal amounts to ensure that rubbers are equally stressed. Secure adjusting nuts in position with the locknuts.

24 VALVE ROCKERS AND PUSH RODS

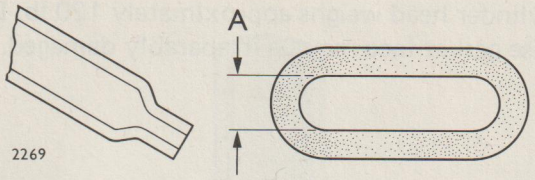
The rockers are bushed and operate on a single shaft clamped in brackets bolted to the cylinder head. An oil feed pipe is a push fit in a drilling at the front of the cylinder head and the peg of the pipe is secured in the rocker shaft by a spring clip.



If there is evidence of inadequate lubrication, crank engine and check for oil flow from oil feed drilling.



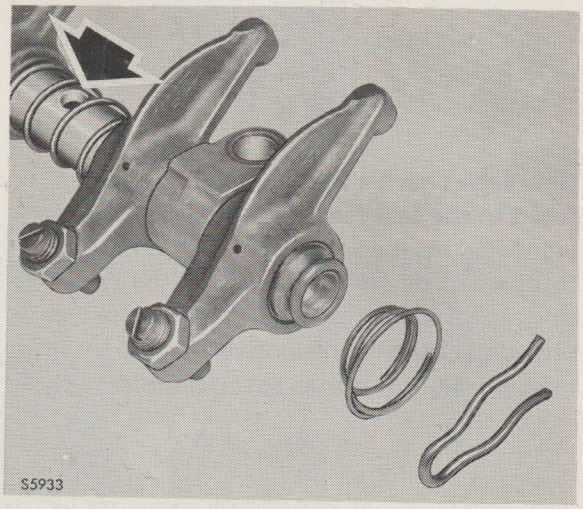
To ensure correct oil feed to rockers, check that dimension 'A' in crimped end of pipe is 0.025 in. (No. 72 drill).



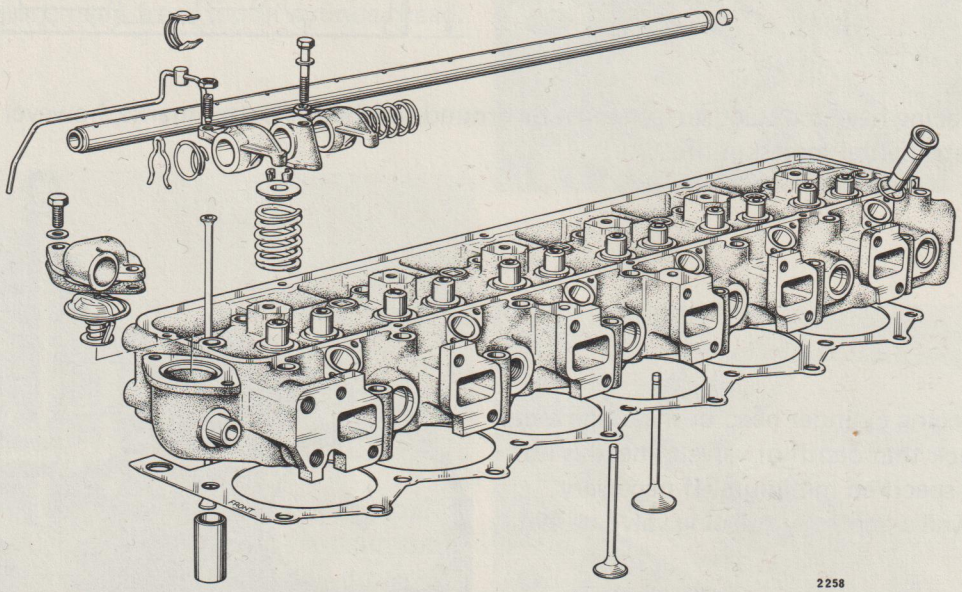
A single push rod may be removed by ensuring corresponding valve is closed and slackening adjusting screw until it is clear of push rod.

Replacement rocker bushes consist of two narrow bushes which should be pressed in from each side of rocker until outer ends are flush. The split in each bush should be to top of rocker. After installation bushes should be honed to provide specified clearance with rocker shaft.

When assembling rockers and brackets to shaft, position shaft oil inlet hole at the top and towards front end of assembly. Assemble end tension springs with their wider coils in contact with lock springs.

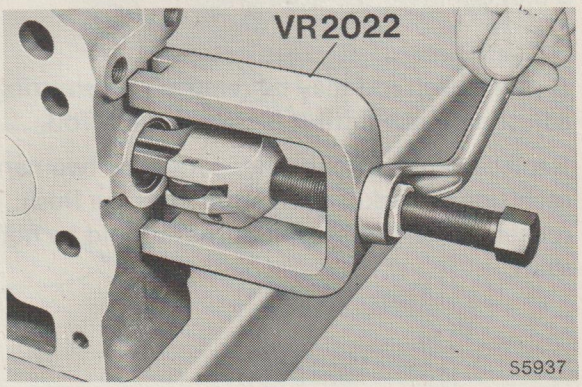


25 CYLINDER HEAD AND VALVES



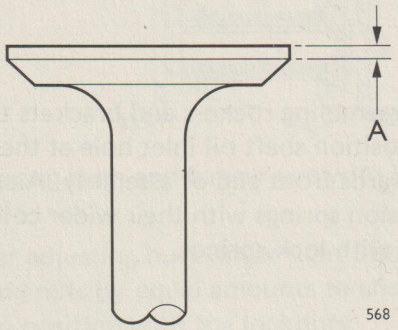
The cylinder head is secured to the cylinder block by bolts. The valves operate direct in the head. The valve rockers operate on a hollow shaft mounted on brackets and are positively lubricated via a drilling in the cylinder block and head. A laminated steel gasket is used. Two dowels locate the head, the front dowel being hollow to communicate the oil drilling in the block and head.

Cylinder head weighs approximately 120 lb. Do not drag head across locating dowels otherwise gasket face may be irreparably damaged.

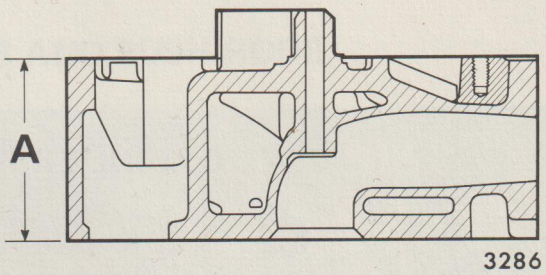


Use Remover VR2022 for withdrawal of cup plug. To facilitate removal, drive plug in slightly to break seal.

When installing, smear plug with sealing compound.

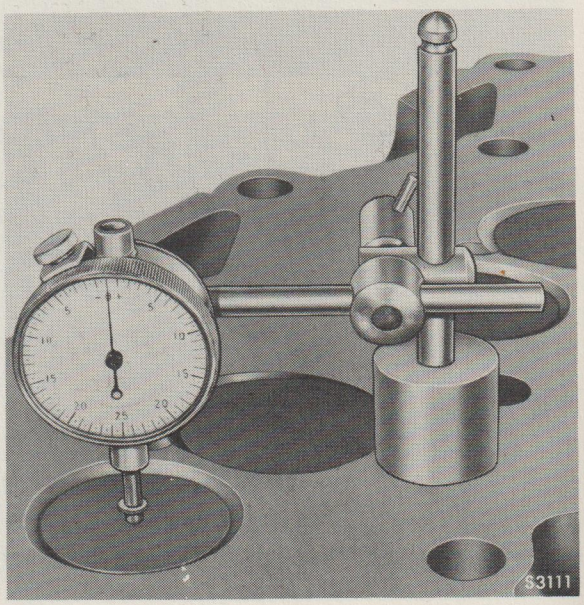


New valves have a thin aluminium coating fused to the seat face. These valves, which are identified by the soft matt finish on the seat face, are ready for installation. Used valves of this type may be refaced in the normal way provided that thickness of valve head 'A' after refacing is not less than specified minimum.



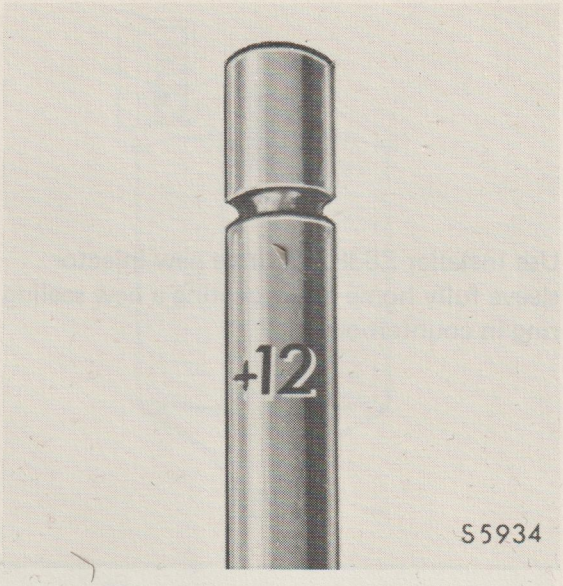
Cylinder head may be refaced providing depth of head is not reduced below specified minimum (dimension 'A').

When refacing head, contact surface must be ground-finished as cutter marks, however small, can be detrimental to gasket life.

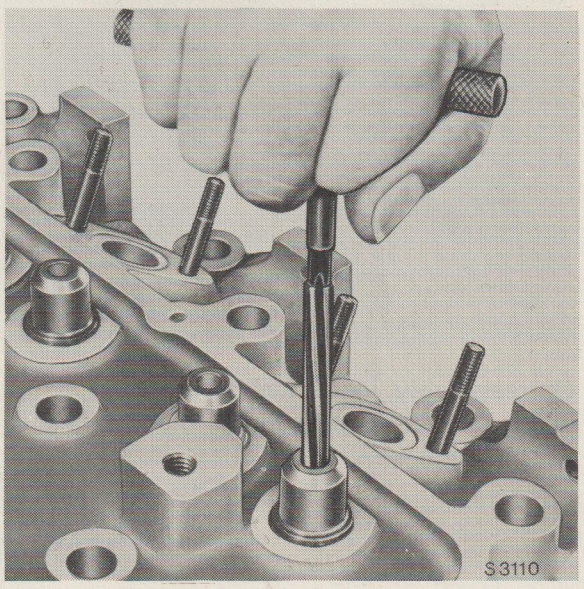


After refacing cylinder head or installing a new valve check that depth of valve in head is not less than specified minimum. If necessary, increase valve depth by refacing valve or seat.

Replacement valves with oversize stems are identified by a number representing oversize in thousandths of an inch stamped on stem.

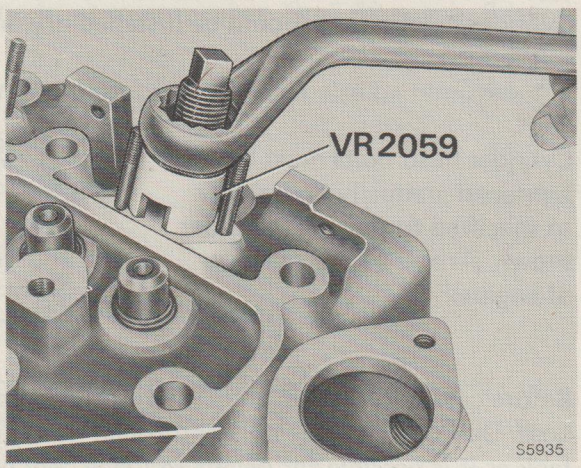


When an oversize valve is required, guide must be reamed to appropriate diameter with Reamer Z8500, Z8501, Z8502 or VR2069 to accomodate a +3, +6, +12 or +24 oversize stem respectively. To ensure an accurate bore at valve port, ream from top of cylinder head.

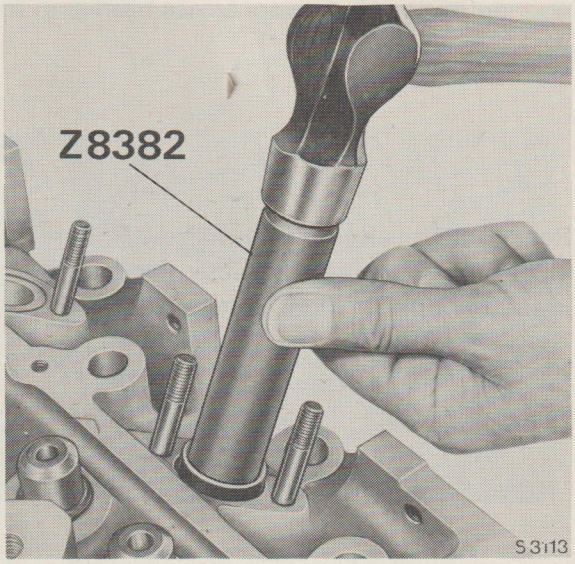


Use Remover VR2059 to extract an injector sleeve from cylinder head.

Cut a thread in sleeve to a depth of approximately 2.00 in. with tap incorporated in tool. Leave tap threaded in sleeve, install thrust block and nut and withdraw sleeve. Remove sealing ring from counterbore in head.

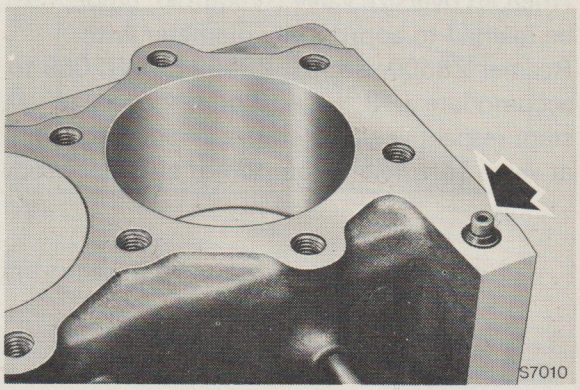


Use Installer Z8382 to drive new injector sleeve fully home after locating a new sealing ring in counterbore.



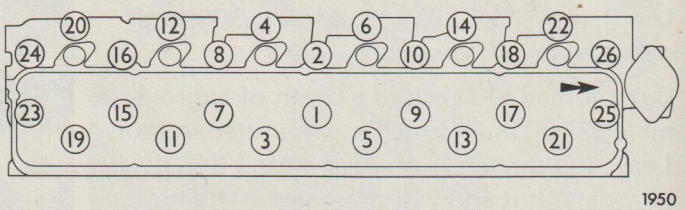
25b CYLINDER HEAD--Installation

On reassembly, locate new sealing rings in water ports at rear of cylinder block face and over front locating dowel.



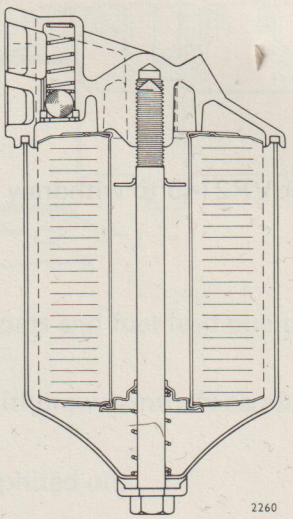
Cylinder head gasket should be installed dry and cylinder head bolts lightly lubricated with EP gear oil.

Cylinder head bolts must be tightened gradually and evenly to specified torque, in the order shown. Arrow indicates front of engine.

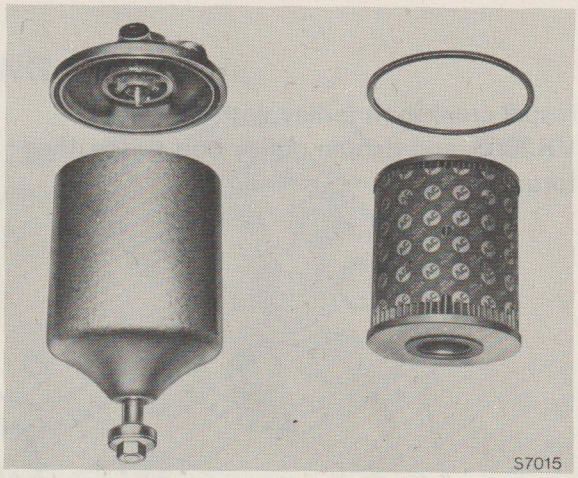


Before connecting hose to the thermostat housing, insert two pellets of Vauxhall Stop Leak in hose. Do not introduce pellets through filler pipe where this is connected to the radiator bottom tank as it is possible for pellets to lodge here out of the normal circulation of coolant.

26 OIL FILTER



The full-flow oil filter incorporates a detachable filter element. The main outlet port of the filter embodies a spring-loaded ball valve which allows oil to by-pass the filter element should it become choked.



To renew element, unscrew filter casing centre bolt and withdraw casing and element. Do not remove protective sleeve from new element.

27 OIL PAN

The pressed-steel oil pan is sealed by a one-piece gasket that is manufactured from an asbestos-based material which expands on contact with oil and must be assembled dry.

To remove oil pan, it is necessary to remove engine front crossmember. On TRP coach, this will entail supporting front of engine.

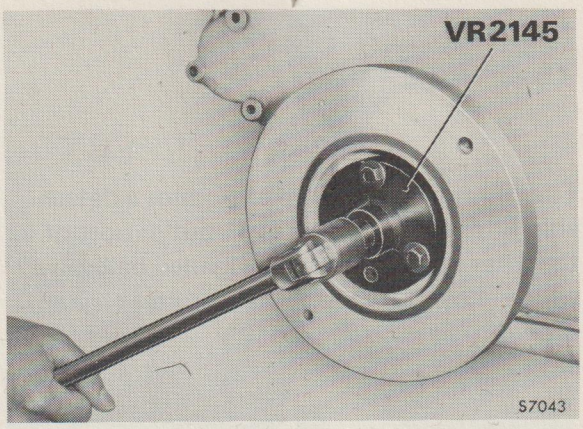
On Series Y coaches, the exhaust shields, oil filler and dipstick tubes must also be removed.

28 CRANKSHAFT PULLEY AND TIMING CASE

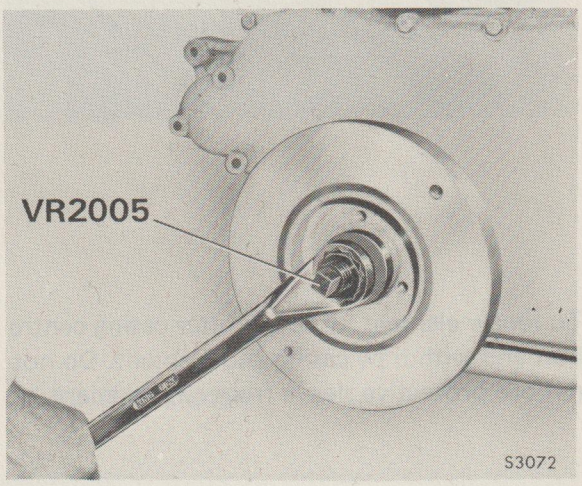
The pulley incorporates a rubber-bonded vibration damper and is a keyed interference fit on the crankshaft spigot. The timing case is located by two dowels on the crankcase front plate. A spring-loaded lip-type seal in the case contacts the crankshaft pulley hub.

28a CRANKSHAFT PULLEY—Removal and Installation

Use Remover VR2145 to withdraw crankshaft pulley.



Install crankshaft pulley with Installer VR2005, and tighten pulley bolt to specified torque.



28b TIMING CASE SEAL—Renewal

Seal can be prised from timing case when in position on engine. New seal must be driven in, open side first, until seal contacts abutment face in housing. Smear lip of seal with recommended lubricant before installing pulley.

28c TIMING CASE—Removal

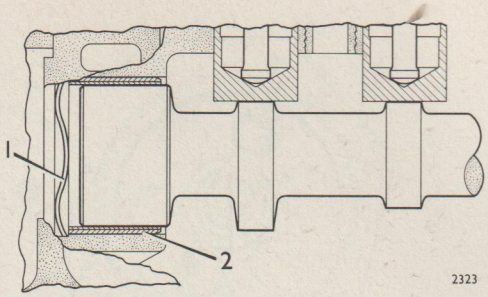
Removal of oil pan and fan belt jockey pulley is necessary when removing timing case.

Power steering pump will remain in position when jockey pulley guide plate bolts are removed. Pump should be supported to prevent strain on flexible hoses.

29 CAMSHAFT

The camshaft is supported by four bearings in the crankcase and the tappets operate direct in the block. Camshaft end float is controlled by a thrust plate located behind the camshaft gear and bolted to the cylinder block.

The camshaft rear bearing (2) is sealed by an expansion plug (1).



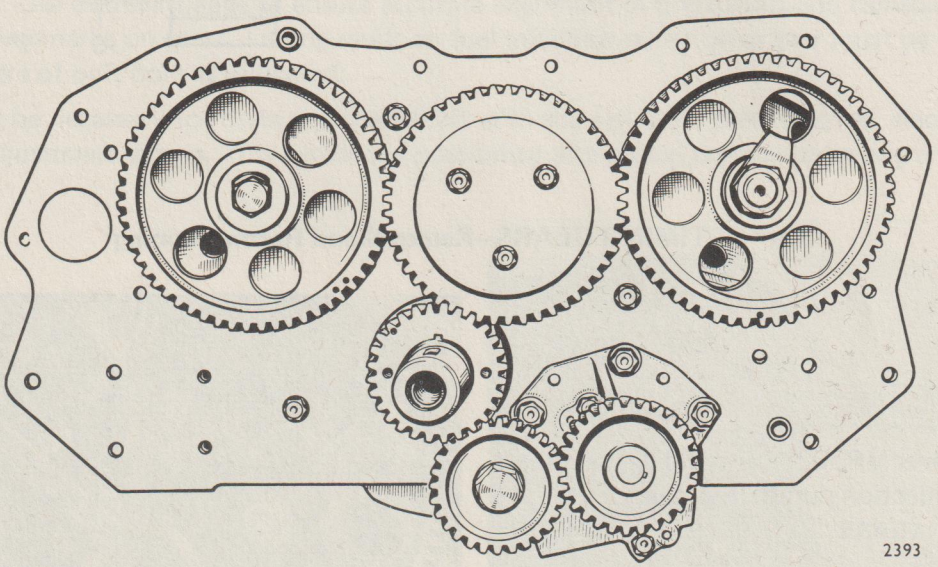
Camshaft can be withdrawn after removing drive gear, tappets and fuel feed pump. On some models it may be necessary to raise engine.

For access to tappets remove push rods and side covers. Withdraw camshaft carefully to avoid damage to bearings in cylinder block.

On reassembly, smear camshaft cams and tappets with graphited oil.

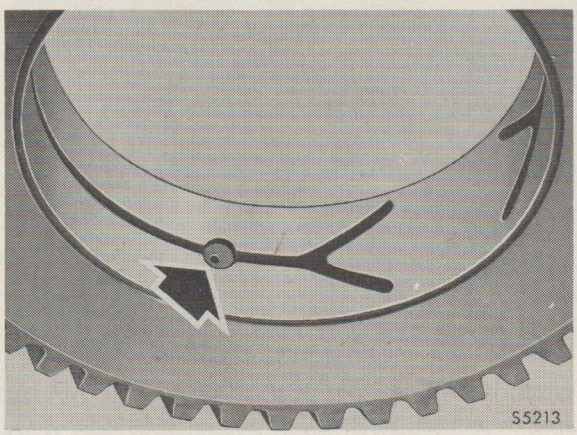
For camshaft bearing renewal, refer to Section 38a.

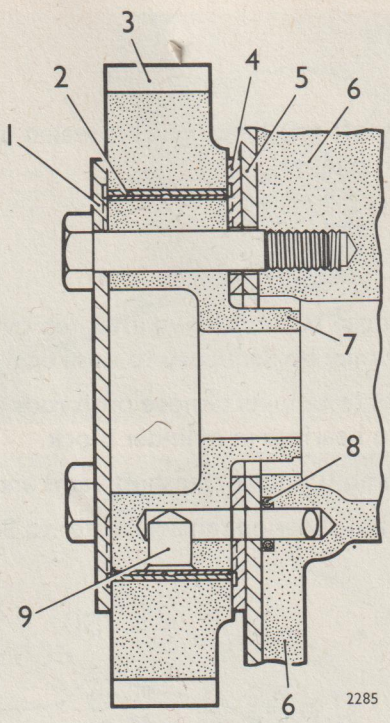
30 TIMING GEARS



The camshaft and fuel injection pump drive gears are driven from the crankshaft gear through an idler gear. The idler gear is bushed and supported on a hub bolted to the crankcase front plate and has a lead-bronze faced steel thrust washer at the front and rear.

Lubrication for the timing gears is provided by the idler gear. Oil is supplied to the idler gear bush via the gear hub and passes through a drilling connecting the oil groove in the bush with the gear teeth.



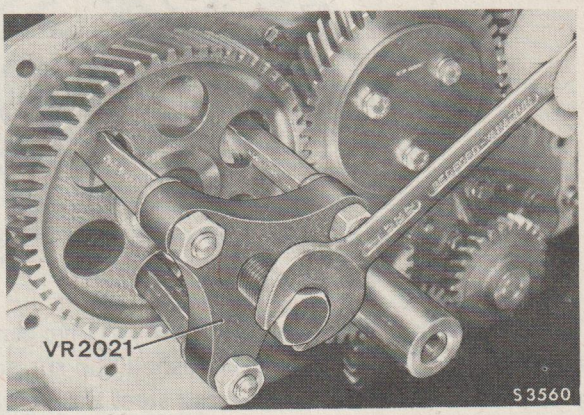


Idler gear and hub details

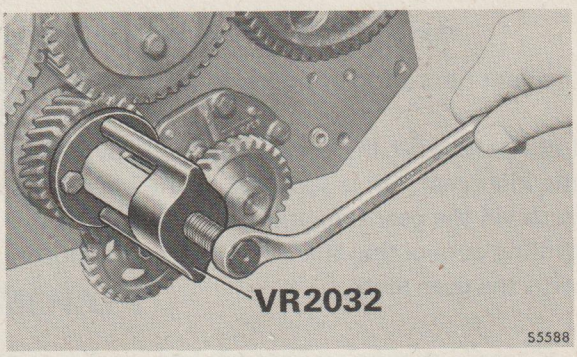
1. Front thrust washer
2. Gear bush
3. Idler gear
4. Rear thrust washer
5. Crankcase front plate
6. Crankcase
7. Idler gear hub
8. Sealing ring
9. Oil drilling

30a TIMING GEARS—Removal and Reconditioning

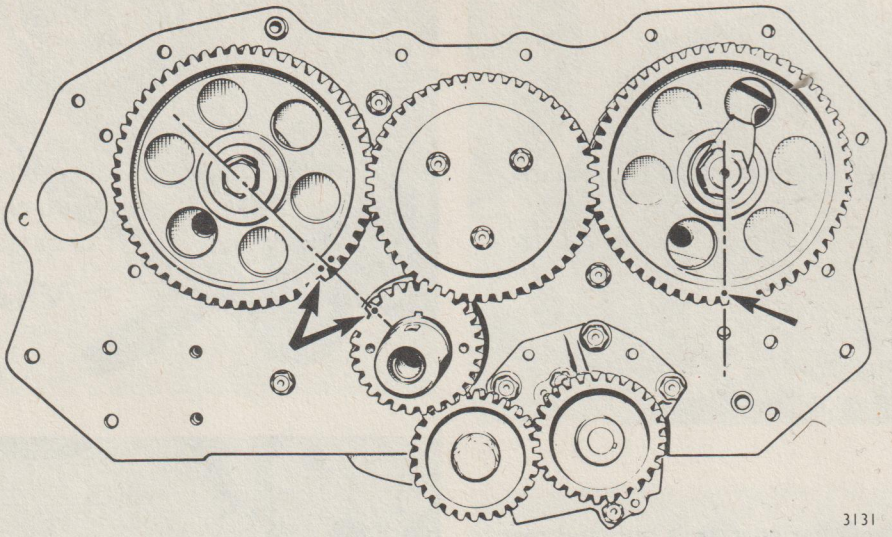
Use Remover VR2021 for removing camshaft and fuel injection pump drive gears.



Use Remover VR2032 for removing crankshaft gear.



When installing idler gear bush, ensure that bush does not protrude beyond either face of gear and that bush hole coincides with oilway in gear. Service bushes are finished to size.

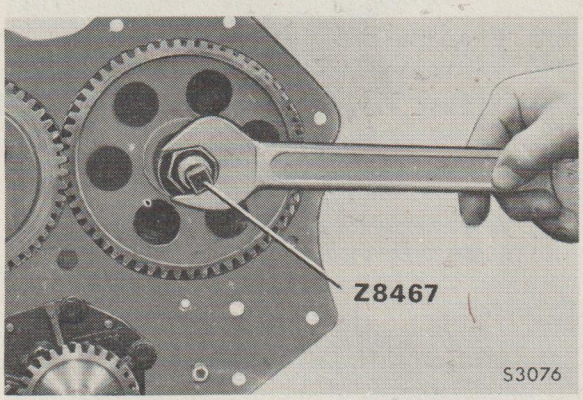


Position flywheel with U/C mark in line with timing aperture pointer and install timing gears as shown. Use a straight edge to ensure accurate alignment of crankshaft and camshaft centres with timing marks on gears. Timing mark on fuel injection pump drive gear must be aligned with centre of bolt hole as indicated.

Should it be necessary to rotate the crankshaft with the camshaft gear removed, slacken the rocker adjustment screws. This avoids the possibility of a piston crown contacting a valve head.

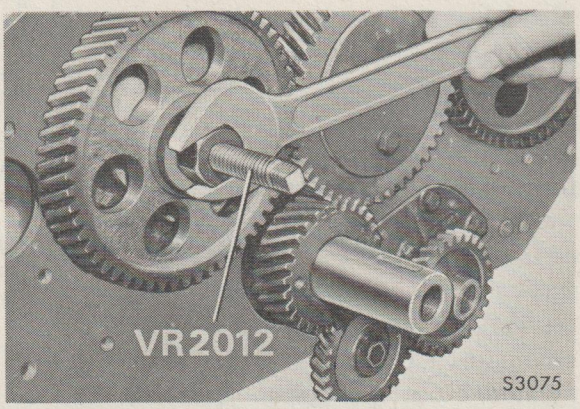
Use Installer Z8467 to install fuel injection pump drive gear.

Do not attempt to drive gear on to compressor as this may damage unit.



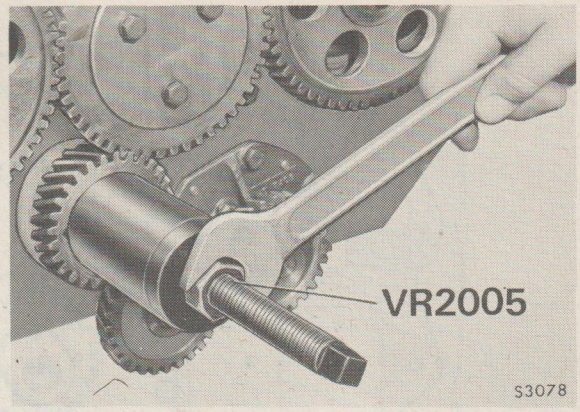
Use Installer VR2012 to install camshaft drive gear.

Do not attempt to drive camshaft drive gear on to camshaft as this will disturb camshaft rear bearing expansion plug.

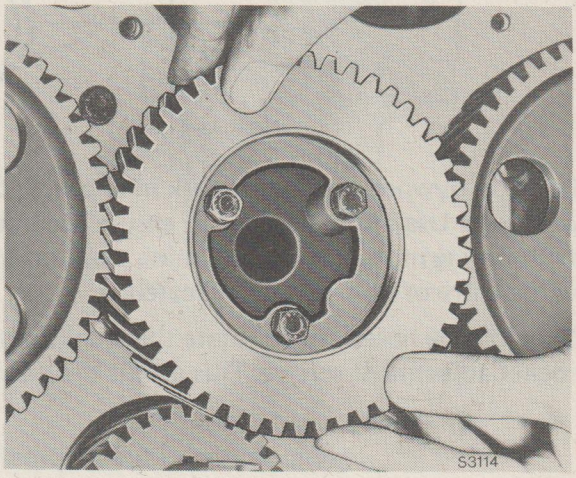


Tighten camshaft gear bolt and fuel injection pump drive gear nut to specified torque.

Use Installer VR2005 to install crankshaft gear.



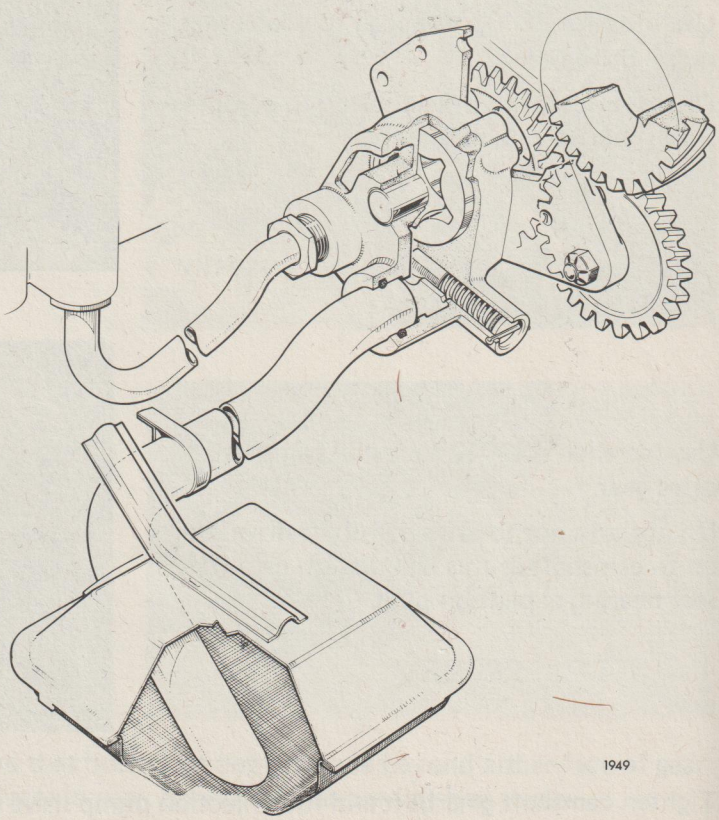
When installing idler gear, bolt hub and rear thrust washer temporarily in position without front thrust washer. Ensure timing marks are correctly aligned and place gear in position, spigotted side towards rear thrust washer. Remove bolts, install front thrust washer and tighten bolts. Slotted side of thrust washers must face gear.



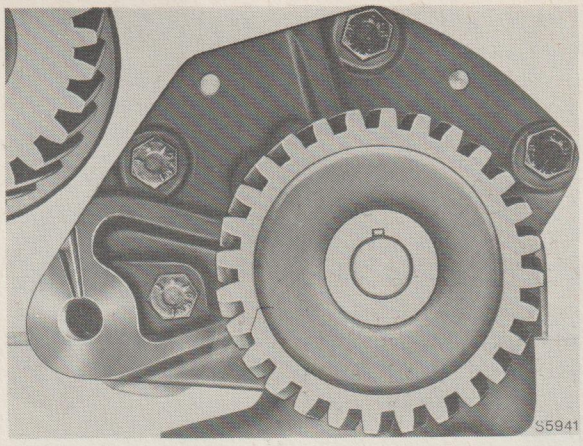
31 OIL PUMP

The internal-lobe rotor-type pump is dowelled and bolted to the crankcase front plate and driven through an idler gear from the crankshaft gear. A spring-loaded plunger-type relief valve is retained in the pump housing by a plug and split pin.

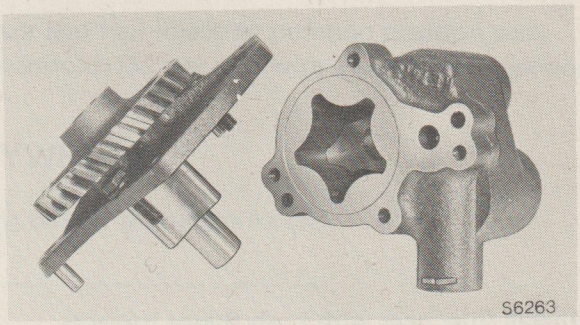
The delivery pipe is secured to the pump and oil filter drilling in the cylinder block by conventional threaded unions but the suction pipe is a push fit in the pump body and sealed by a neoprene ring. The other end of the suction pipe is located through a neoprene ring in the oil pump screen cover and secured by a clip bolted to the cylinder block. The screen cover is mounted on brackets bolted to the cylinder block.



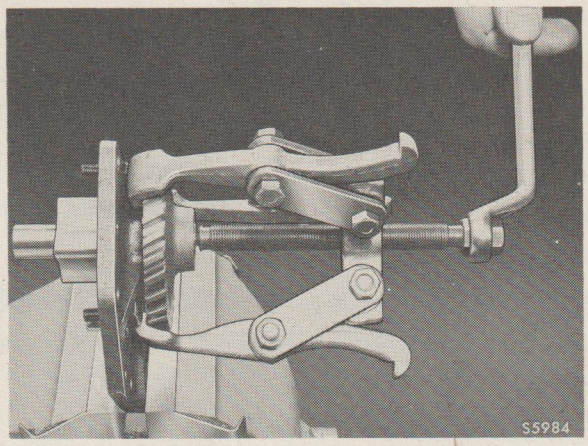
Oil pump idler gear must be removed to gain access to one of the pump securing bolts. Shaft is secured to the oil pump front plate by a nut.



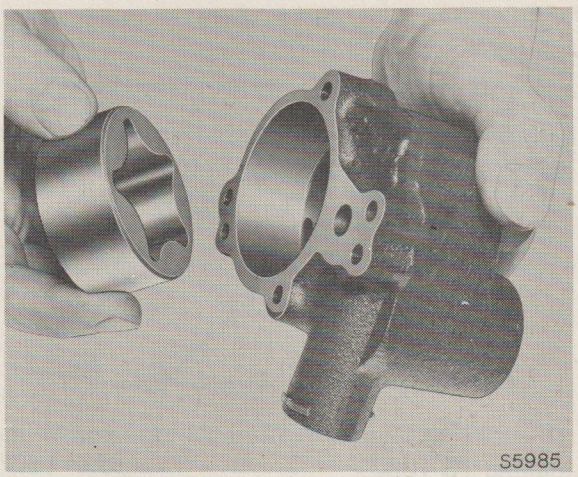
Drive gear, front plate and rotor can be removed from body as an assembly.



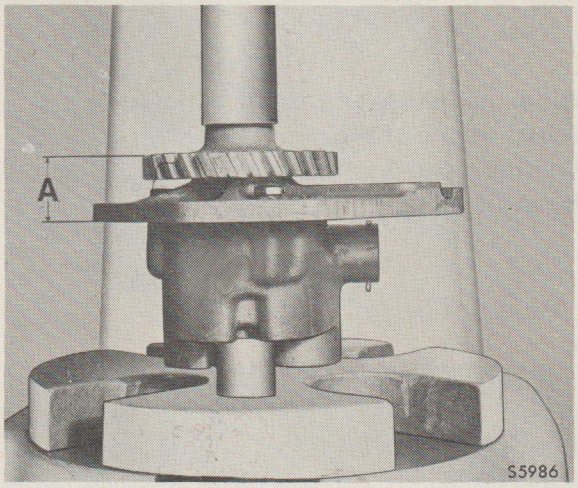
Withdraw drive gear with a claw-type drag.



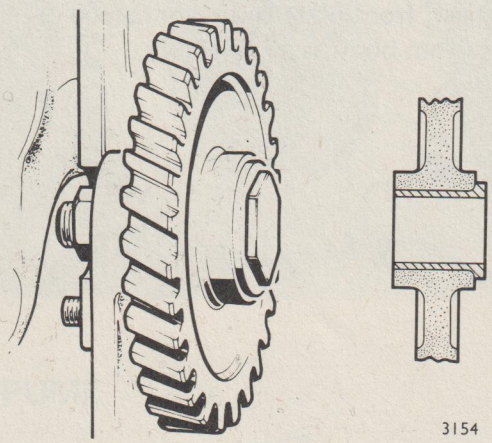
Ensure that outer rotor is assembled with its chamfered face towards pump body.



Tighten pump front plate securing bolts evenly and check that rotor turns freely after final tightening.

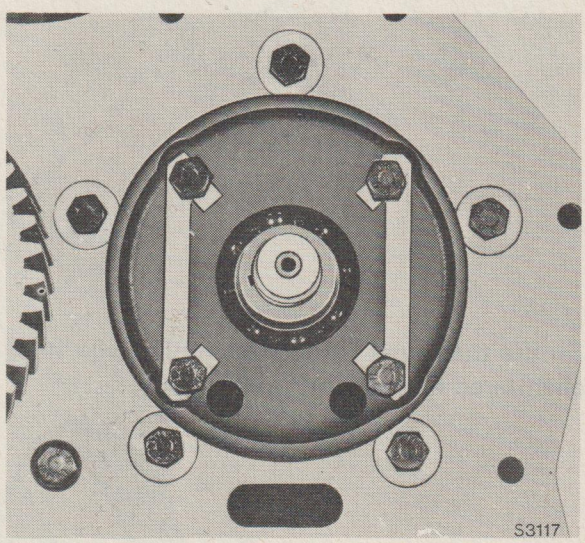


Support lower end of shaft when installing gear. Dimension 'A' is 1.02 in.



Install idler gear with bush flange towards hexagon head of idler gear shaft.

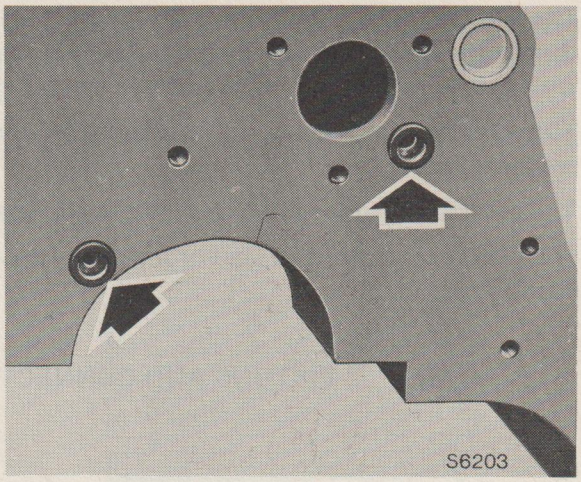
32 AIR COMPRESSOR



Compressor can be removed after removing drive gear and five securing bolts.

Information on disassembling and reassembling the compressor is contained in Training Manual TS 1087.

33 CRANKCASE FRONT PLATE

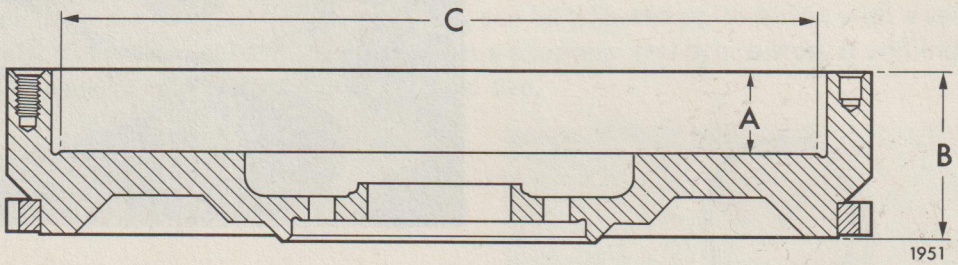


The crankcase front plate is secured to the crankcase by five bolts in addition to the bolts securing the timing case. A gasket is interposed between the plate and crankcase and neoprene rings are located in the counterbore of each oil feed drilling.

The front plate can be removed leaving compressor and fuel injection pump in position supported by a length of wire attached to exhaust manifold. Do not pass wire around fuel injection pipes.

34 FLYWHEEL

A 'pot' type flywheel is used in a circular housing bolted to the crankcase.



When refacing flywheel friction face, maintain dimension 'A' within specified limits by machining a corresponding amount of material from clutch mounting rim.

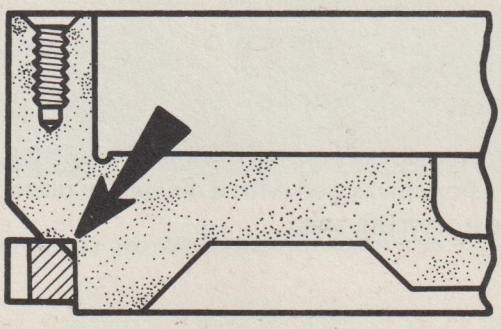
Friction face should be ground finished.

Flywheel is unfit for further service when dimension 'B' is reduced below specified minimum.

After refacing, check diameter 'C' and if necessary re-machine the 0.08 in. radius undercut to maintain this dimension.

	P Engine	C and R Engines
Dimension 'A'	1.497/1.503 in.	1.572/1.578 in.
Dimension 'B' (minimum)	3.072 in.	3.147 in.
Diameter 'C'	14.00 in.	15.00 in.

When installing a new ring gear, expand by heating to a temperature of 320°C (dark blue colour) and install gear with chamfered inner edge towards flywheel flange.



Flywheel bolts must be tightened evenly to specified torque.

35 PISTONS AND CONNECTING RODS

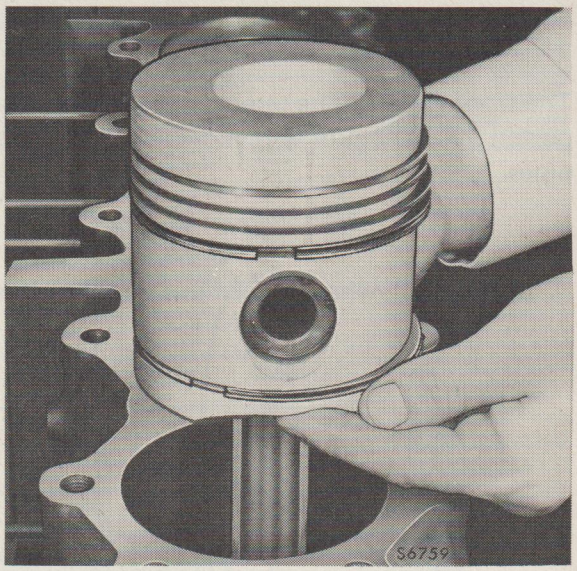
The pistons are of aluminium alloy with a toroidal combustion chamber offset away from the thrust side. The fully floating piston pins are retained by circlips and the pistons are provided with three compression rings and two slotted type scraper rings.

The outer face of the top ring is inlaid with chromium. The second and third compression rings are taper faced.

The connecting rods have detachable shell-type bearings with caps secured with nuts and bolts.

The piston pin bush is of lead-bronze and lubricated through a drilling in the top of the connecting rod.

35a PISTONS AND CONNECTING RODS—Removal and Inspection

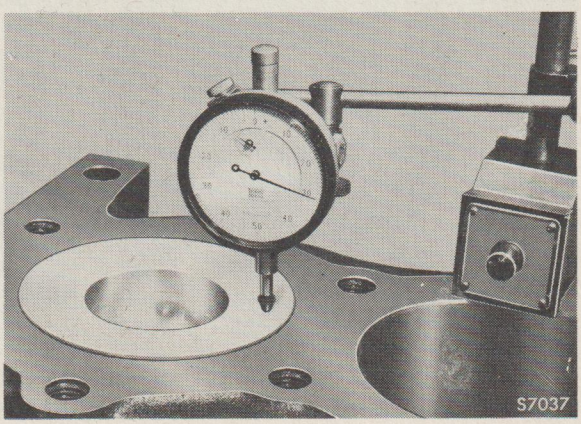


Piston and connecting rod must be withdrawn through top of cylinder block.

Three piston height grades are available for selection to attain the specified piston protrusion above the cylinder block face. These are identified by the numbers 1, 2 and 3 stamped on the piston crown for +0.005 in., standard and −0.005 in., respectively.

When renewing a piston, replace old with a piston of the same height grading. Should the height grading number on the old piston be indiscernable, the following procedure should be adopted to establish which piston height grade is required.

Assemble a piston of standard height, complete with rings, on to the connecting rod and install in cylinder as for normal engine assembly. Rotate crankshaft three turns to centre piston in bore.



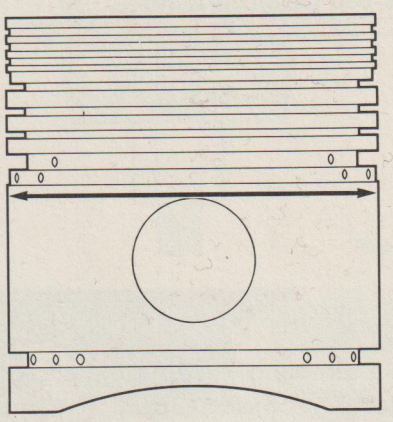
Rotate crankshaft until piston is at maximum protrusion, measured with a dial gauge placed above piston pin axis.

If the protrusion is within the specified limits the standard height piston is correct. A protrusion below limits indicates that a +0.005 in. height piston is required and a protrusion above limits indicates the need for a −0.005 in. height piston.

Installation of a new or rebushed connecting rod may affect piston protrusion which should be measured as previously described.

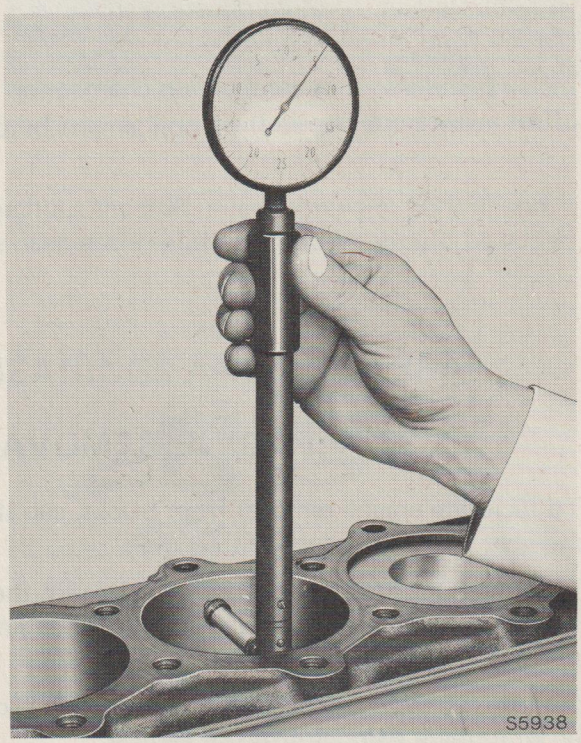
When assessing piston to bore clearance, and when reboring, maximum accuracy in piston and bore measurement is essential.

As piston skirt is ground both oval and tapered, it is imperative that piston size is measured only at right-angles to piston pin and 2.20 in. from piston crown.



Micrometer spindle must turn freely so that it can be adjusted up to piston with a very light turning effort. If micrometer is adjusted to get a frictional feel over piston, it will indicate a dimension significantly smaller than the actual size.

When checking cylinder bores it is not sufficiently accurate to take a direct reading from an inside micrometer. For maximum accuracy, a cylinder gauge should be used, in conjunction with the same micrometer as used for measuring piston. By this method, any discrepancy between individual micrometers is avoided.



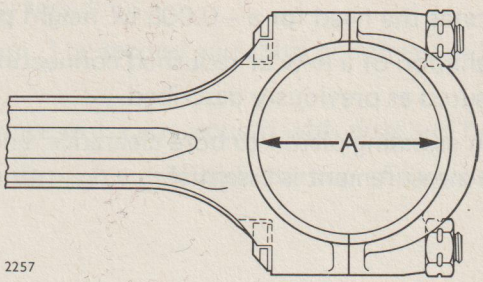
Maximum piston oversize is 0.040 in., except when liners are installed, when the maximum is 0.020 in.

Pistons and pins are serviced as selective assemblies. Grading is shown by letters P or PP on piston crown which correspond with I or II respectively on end of piston pin.

For information on cylinder bore refinishing, refer to Section 38a.

Before installing new piston rings in a worn bore remove oil glaze with a brush-type de-glazer.

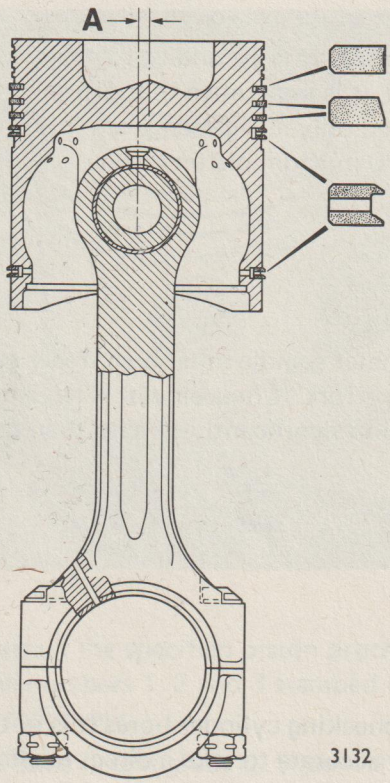
Before assembling rod to piston, check that diameter 'A' of bearing housing bore is within specified limits. This will determine whether cap has been filed.



Correct assembly of piston rings and piston to connecting rod is as shown. The lower scraper ring used in production has parallel lands and may be installed either way up. Ring gaps must be equally spaced around piston.

Note that offset 'A' of combustion chamber is away from oil bleed hole side of rod.

Install pistons so that combustion chamber is offset away from camshaft.



36 ENGINE REMOVAL AND INSTALLATION

To facilitate engine removal from trucks, cab should be removed. Engine rear support crossmember can be removed with engine.

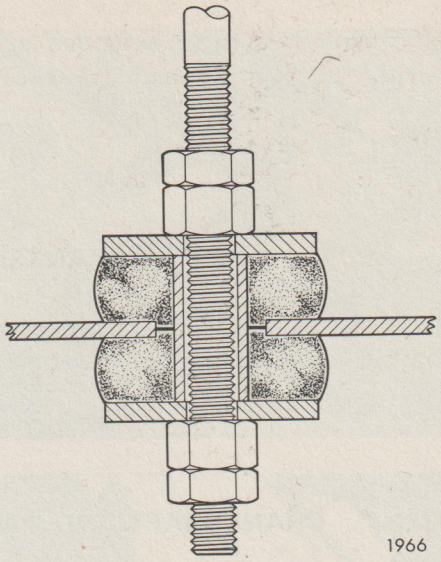
When it is not practical to remove cab, as in the case of an integral cab and body, it will be necessary to remove front axle and lower engine through chassis, leaving rear support crossmember in position on chassis.

On front-engined coaches, chassis frame front crossmember is detachable, permitting engine to be withdrawn through front of vehicle.

On mid-engined coaches, engine can be lowered, using lifting gear operating through a ventilator aperture directly above engine access hatch. After removing transmission, engine mounting crossmember brackets should be released from chassis sidemembers, and crossmembers and brackets lowered with engine.

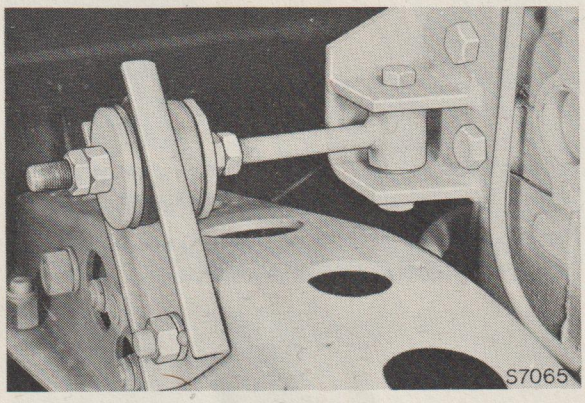
On installation, slacken bolts securing brackets to rear mounting crossmember, to assist entry of brackets between chassis sidemembers.

Adjust torque reaction rod by tightening adjusting nuts finger tight until rubbers contact bracket. Using a wrench, tighten adjusting nuts by equal amounts to ensure that rubbers are equally stressed. Secure adjusting nuts in position with the lock nuts.



1966

On Series YRT coach, an engine restraining rod is assembled between the cylinder block and rear mounting crossmember. On assembly, adjust the rod nuts using the procedure detailed for the torque reaction rod.



S7065

When filling the oil pan of a short motor or rebored engine, add 16 fl oz of zinc dithiophosphate additive as a running-in compound.

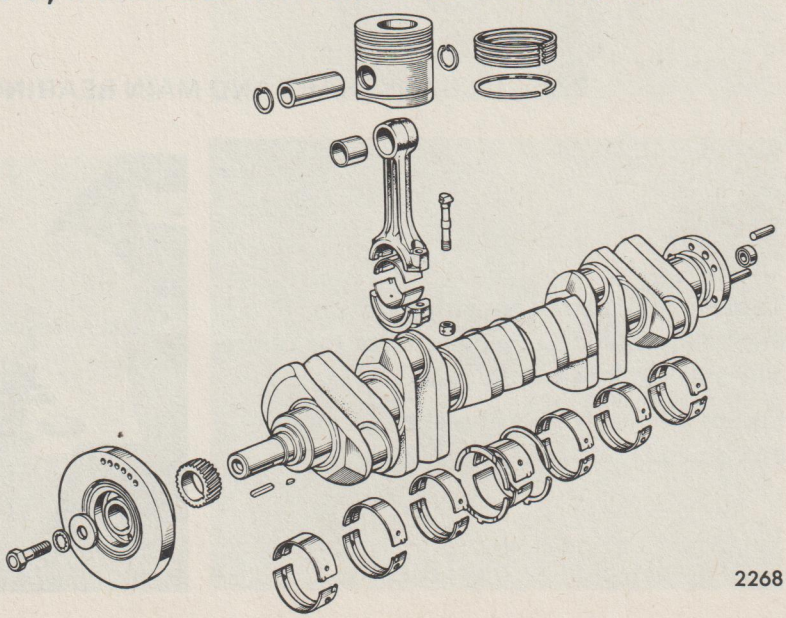
It is essential that the additive is used only throughout the 500 miles running-in period, and, should the oil be changed before 500 miles have been accomplished, additive should be added to the fresh oil.

37 CRANKSHAFT, MAIN BEARINGS AND REAR SEAL

The crankshaft is supported by seven main bearings and end float is controlled by thrust washers located each side of the centre bearing.

A two-piece seal contacts the crankshaft at the rear and a spring-loaded lip-type seal in the timing case contacts the crankshaft pulley hub.

Two dowels in the rear flange locate the flywheel.



2268

37 CRANKSHAFT, MAIN BEARINGS AND REAR SEAL (contd)

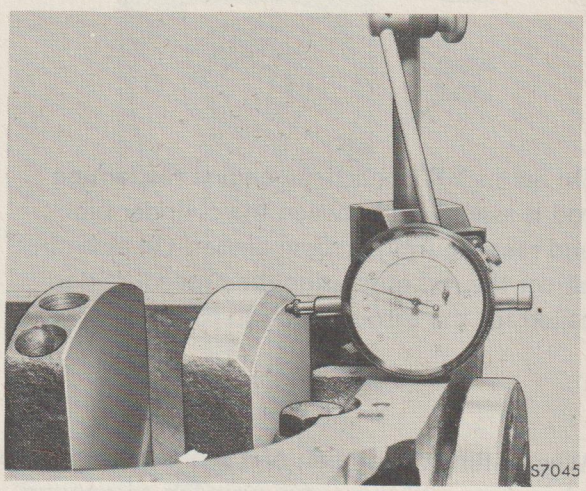
The rear main bearing cap is extended and cork seals are inserted between the sides of the cap and the cylinder block. In service, felt seals are used.

37a CRANKSHAFT REAR SEAL—Renewal

Crankshaft rear seal renewal necessitates engine removal. To gain access to seal, withdraw crankshaft, leaving pistons and connecting rods in cylinder bores.

37b CRANKSHAFT AND MAIN BEARINGS—Removal and Reconditioning

Before removing crankshaft during engine overhaul, check end float to determine if thrust washers on centre bearing are worn. Oversize thrust washers are serviced.



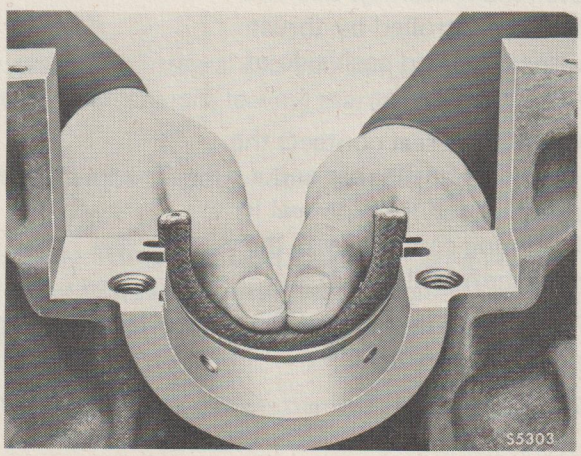
It is permissible to regrind crankshaft to 0.020 in. undersize. After regrinding, main journal and crankpin fillets must be re-rolled to specified radius to ensure maximum resistance to fatigue.

Whenever a crankshaft is reground or a replacement crankshaft installed it will be necessary to check piston protrusion above cylinder block face as detailed in Section 35.

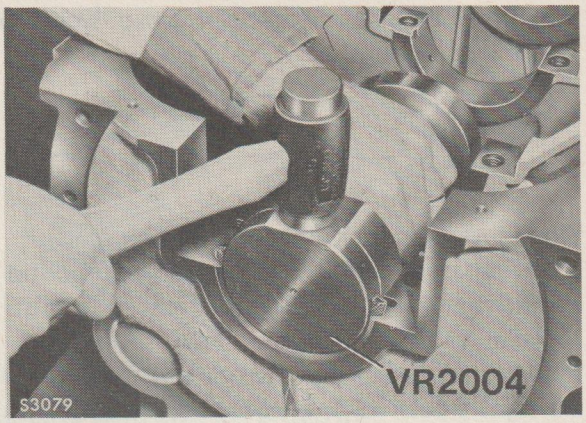
37c CRANKSHAFT AND MAIN BEARINGS—Installation

To renew rear seal, press strip into groove in crankcase block, commencing at the centre and working towards the sides.

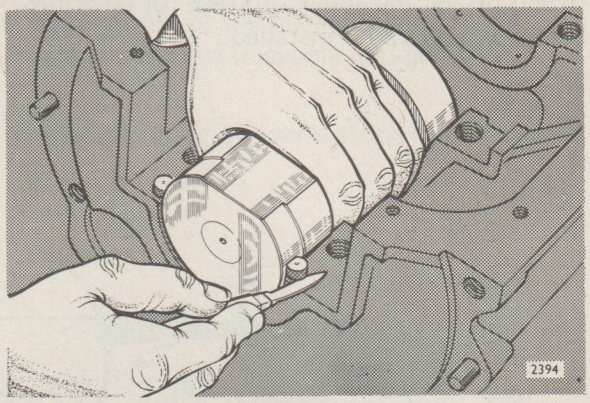
Ensure that both ends of seal project above bearing cap locating face.



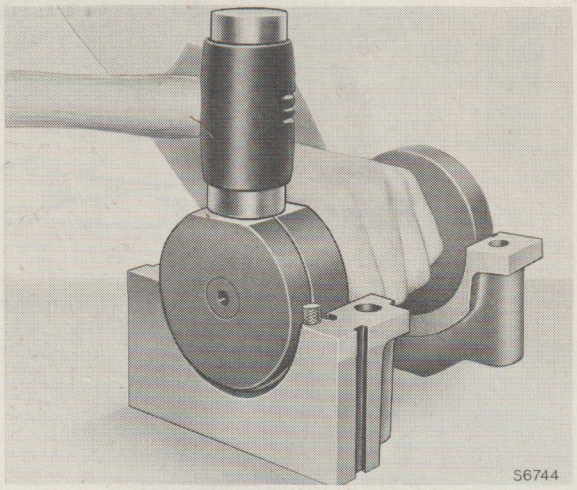
Place Installer VR2004 in position so that larger end is on seal and other end rests in adjacent main bearing housing. Drive seal into position by hammering on flat of installer, and simultaneously applying a semi-rotary movement until installer is felt to bottom.



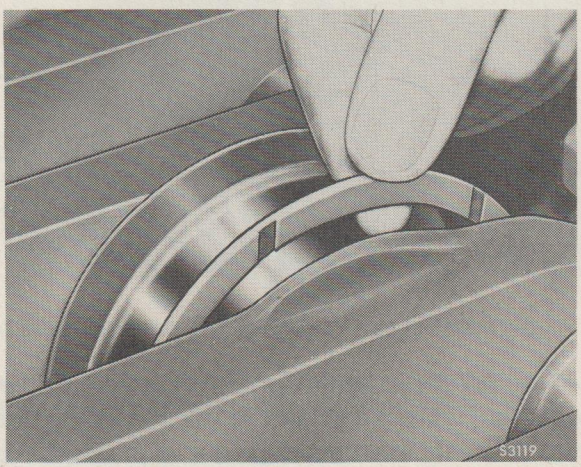
With installer held firmly in position, and using a sharp knife, cut off projecting ends of seal flush with bearing cap locating face. Do not leave frayed ends to become trapped beneath bearing cap. Smear seal liberally with recommended lubricant.



Install seal strip in bearing cap in a similar manner, using front bearing cap as a guide for seal installer.

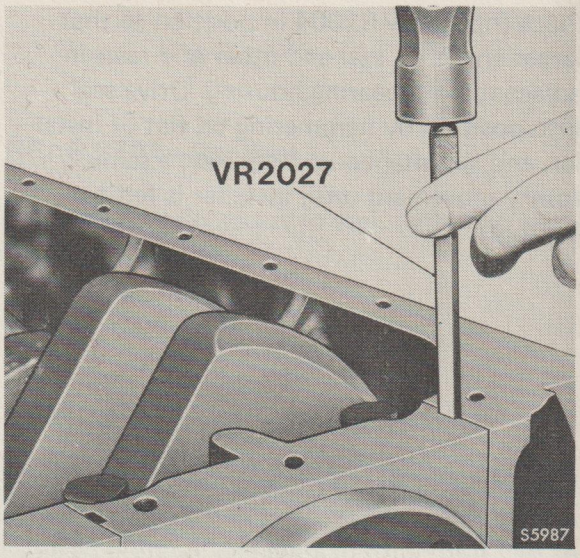


Crankshaft thrust washer oil grooves must face crankshaft thrust faces.

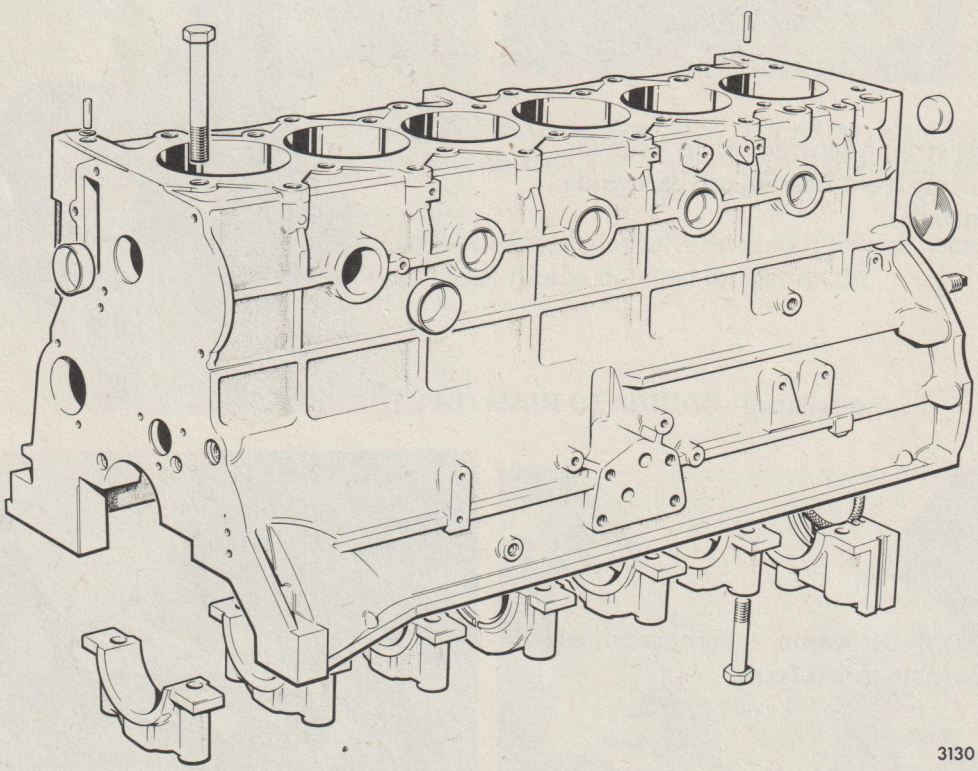


When installing rear main bearing cap, smear mating faces of cap and crankcase with Wellseal jointing compound.

When installing rear main bearing cap seals, coat first piece of felt with jointing compound and drive home this and subsequent felts with Installer VR2027. Approximately six felts are required for each groove. Ensure that felts are tightly packed, and leave about 0.010 in. of felt projecting above cap face for compression when oil pan is installed.



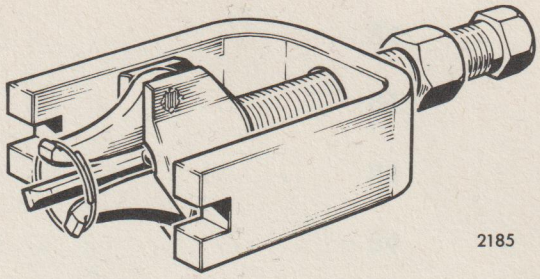
38 CYLINDER BLOCK



An oil gallery extends from front to rear of the cylinder block and is sealed by plugs. Oilways direct oil from the gallery to the crankshaft and camshaft bearings and a vertical drilling above the camshaft front bearing directs oil to the rocker gear.

Refacing of the cylinder block top face is not permissible.

Cup plugs may be withdrawn with Remover VR2022. To facilitate removal, drive plug slightly inwards to break seal.


2185

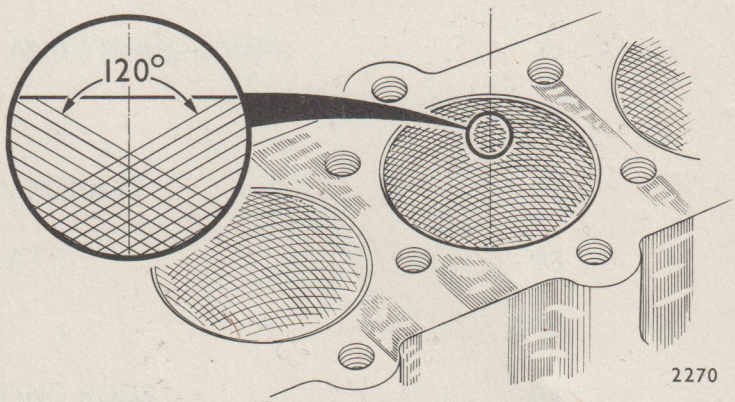
When installing, smear periphery of plug with jointing compound.

Cylinder liners are available. Maximum piston oversize with liners is 0.020 in.

Cylinder bores must be hone finished, with clean sharp stones of the proper grade for the required amount of metal to be removed. Dull or dirty stones cut unevenly and generate excessive heat.

When making initial cuts, leave sufficient metal so that all cutter or coarse stone marks may be removed with the fine stones used for finishing.

When finish honing, pass hone through entire length of cylinder at a rate that will produce a cross hatch pattern of 30° to the horizontal (120° included angle to axis of bore). This will ensure maximum ring life and minimum oil consumption. Select finishing stones of a grade to produce a surface finish of 15—35 micro-inches.

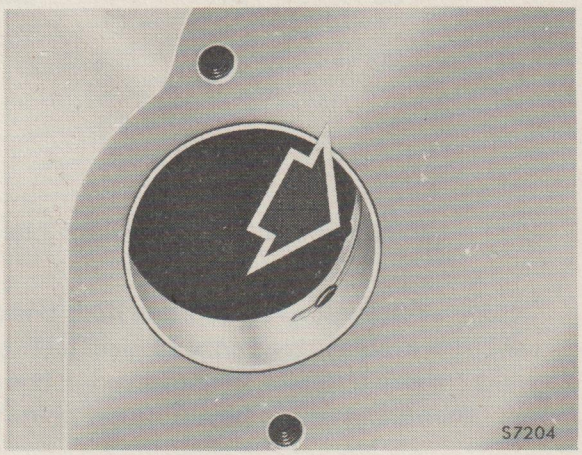


2270

It is of greatest importance that refinished cylinder bores do not exceed 0.0005 in. out-of-round or taper.

Camshaft rear bearing expansion plug will be driven out during bearing removal.

When installing bearings, work in succession from the rear, and ensure that oil holes coincide with oilways in crankcase. Each bearing must be located so that notches face rearward. Front bearing must not project beyond crankcase front face.


S7204

Replacement bearings are prefinished to size and must be installed in sets to ensure bearing alignment.

Before installing rear bearing expansion plug, apply Loctite Grade AVV to periphery of plug for additional retention and sealing.

214 cu in. GASOLINE ENGINE

VALVE TIMING CHECK 83

VALVE CLEARANCE ADJUSTMENT 84

ENGINE FRONT MOUNTINGS 84

ENGINE REAR MOUNTINGS 84

VALVE ROCKERS AND PUSH RODS 84

CYLINDER HEAD AND VALVES 85

VALVE TAPPETS 88

OIL FILTER 88

OIL PAN 88

OIL PUMP AND STRAINER 89

CRANKSHAFT PULLEY AND TIMING COVER 90

TIMING CHAIN 92

TIMING WHEELS AND CAMSHAFT 92

CRANKCASE FRONT PLATE 93

FLYWHEEL 94

PISTONS AND CONNECTING RODS 94

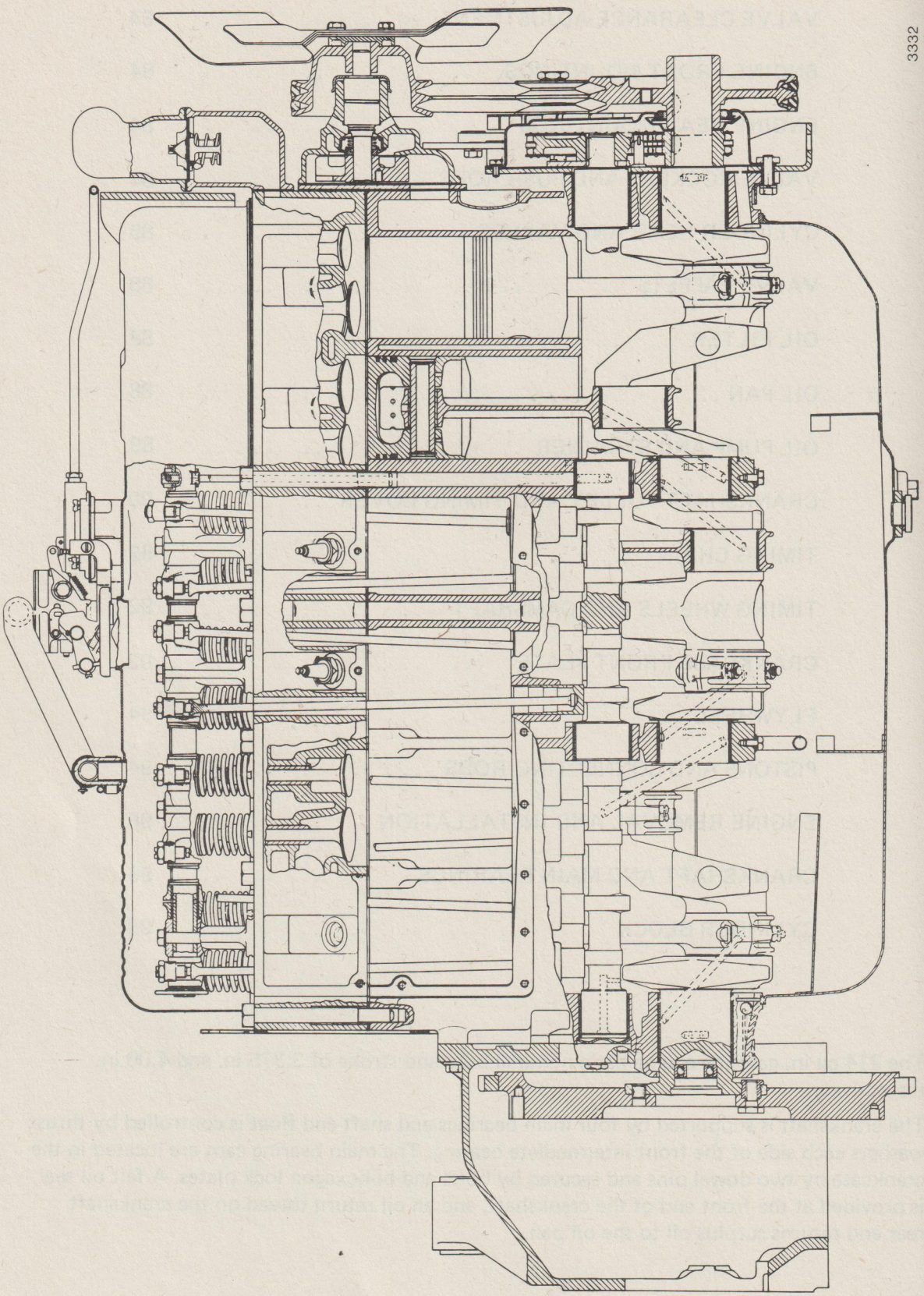
ENGINE REMOVAL AND INSTALLATION 96

CRANKSHAFT AND MAIN BEARINGS 96

CYLINDER BLOCK 98

The 214 cu in. gasoline engine has a nominal bore and stroke of 3.375 in. and 4.00 in. respectively.

The crankshaft is supported by four main bearings and shaft end float is controlled by thrust washers each side of the front intermediate bearing. The main bearing caps are located in the crankcase by two dowel pins and secured by bolts and bi-hexagon lock plates. A felt oil seal is provided at the front end of the crankshaft, and an oil return thread on the crankshaft rear end returns surplus oil to the oil pan.



3332

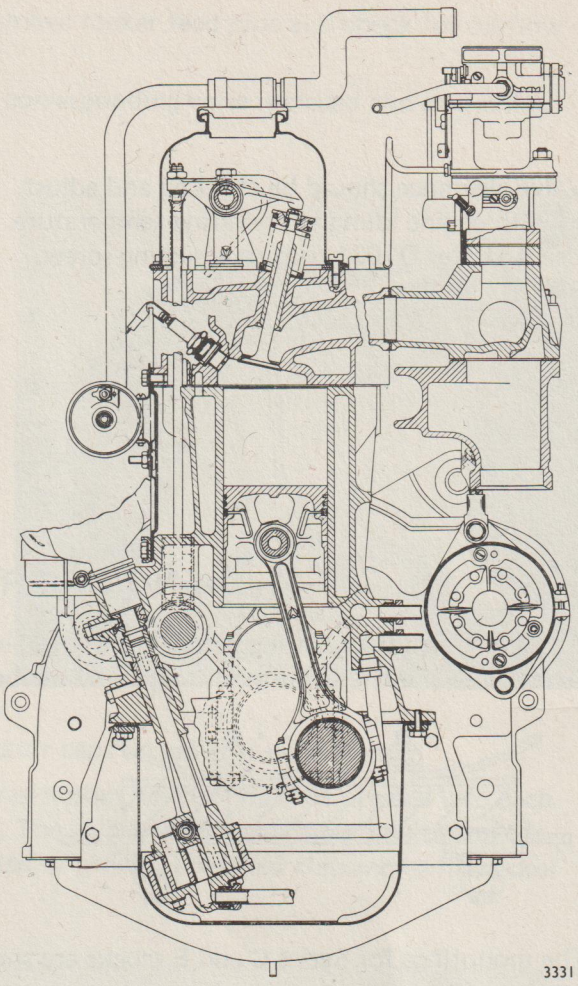
The split-skirt aluminium alloy pistons carry three rings, two compression rings and one scraper ring located above the piston pin which is retained in the piston by circlips.

Four bearings support the camshaft, which is chain driven; a thrust plate bolted to the cylinder block controls camshaft end float. An integral skew gear on the camshaft drives the ignition distributor and oil pump.

The inclined valves, carried in renewable guides are operated via the rocker gear by push rods and tappets. Rotator caps are used on the exhaust valves. A vertical drilling in the cylinder block and a cylinder head bolt conveys oil, from the camshaft front intermediate bearing, to the rocker gear oil feed pipe.

The gear-type oil pump is mounted in the right-hand side of the crankcase and is secured in position with a setscrew and locknut. The pump incorporates a spring-loaded plunger-type relief valve. A full-flow type oil filter with a detachable element is bolted with an adaptor plate to the crankcase.

The crankcase is ventilated through a hose connected between the push rod cover and the clean side of the carburetter air cleaner.



3331

39 VALVE TIMING CHECK

Valve timing can be checked by the following method, without removing the timing cover:

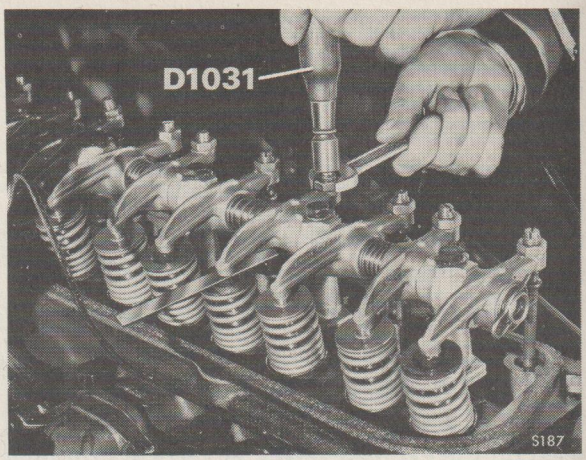
(a) Remove the flywheel underpan and mark the flywheel on the 34th tooth from the U/C mark, counting in the opposite direction of engine rotation.

(b) Mount a dial gauge over No. 1 intake valve (on some engines it is more convenient to use the intake valve of the rear cylinder) with gauge plunger contacting spring cap.

(c) Turn the engine in the normal direction of rotation until, by observing the gauge, the intake valve is seen to be fully open. At this point, the mark made on the flywheel should coincide with the pointer in the timing aperture in the clutch housing.

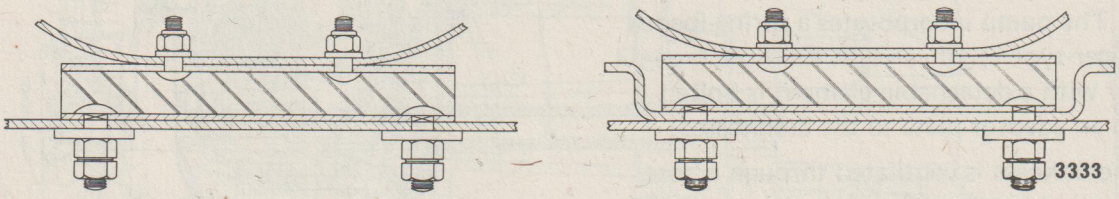
40 VALVE CLEARANCE ADJUSTMENT

Valve clearance should be checked and adjusted with engine idling at operating temperature. Use Adjuster D1031 to turn adjusting screw.



41 ENGINE FRONT MOUNTINGS

The engine front mounting comprises a single insulator that is located between the crankcase front plate and the front mounting crossmember.



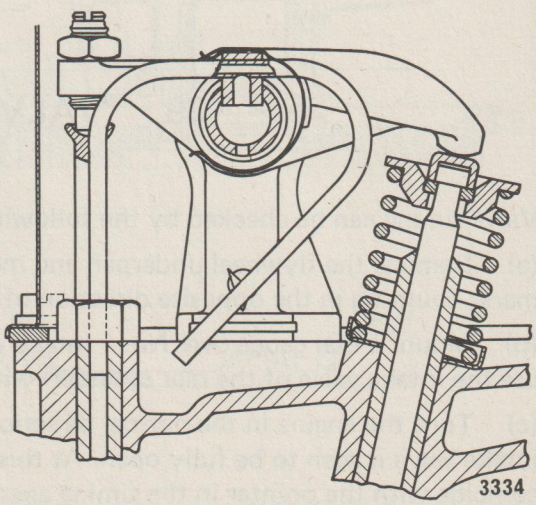
The mountings for Series C and E trucks are shown at left and right respectively.

42 ENGINE REAR MOUNTINGS

Refer to Section 4.

43 VALVE ROCKERS AND PUSH RODS

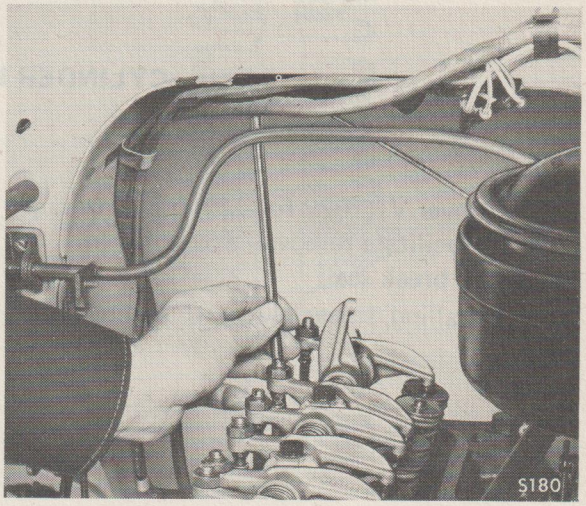
The rockers are bushed and operate on a single shaft secured in brackets bolted to the cylinder head. An oil feed pipe is a push fit in a vertical drilling through one of the cylinder head bolts and the peg of the pipe is secured in the rocker shaft by a spring clip.



If there is evidence of inadequate lubrication remove rocker feed pipe and check for oil flow from oil feed drilling in cylinder head bolt.

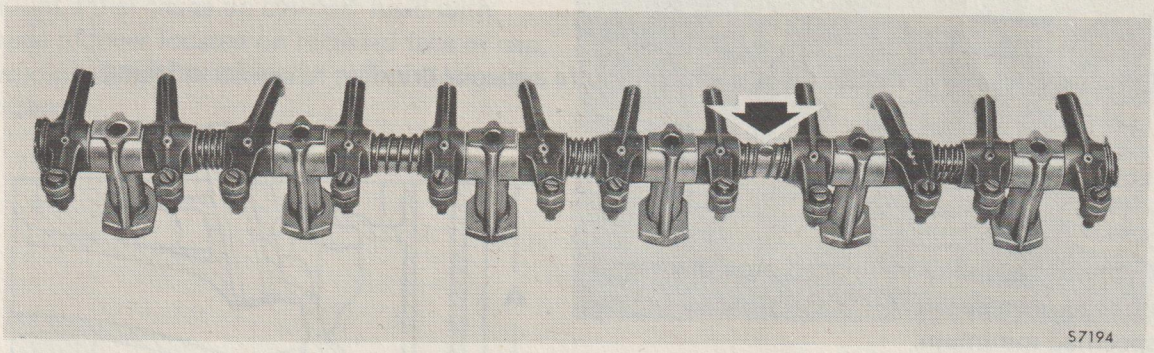
A single push rod may be removed by ensuring corresponding valve is closed and slackening adjusting screw until it is clear of push rod.

On Series C trucks, Nos. 11 and 12 push rods can be removed via hole in scuttle, after removing rubber plug.



When removing rocker shaft, do not disturb rotator caps on exhaust valve stems.

Replacement rocker bushes consist of two narrow bushes which should be pressed into each side of the rocker until the outer ends are flush. The split in each bush should be to top of rocker. After installation, bushes should be honed to provide specified clearance with rocker shaft.



When assembling rockers and brackets to shaft, position oil inlet hole at the top and between Nos. 4 and 5 rockers.

Rocker shaft springs of two different lengths are used. Longer springs are assembled between exhaust rockers.

Assemble end tension springs on rocker shaft with their wider coils in contact with lock springs.

Before installing rocker gear, check that rotator caps are in position on exhaust valves.

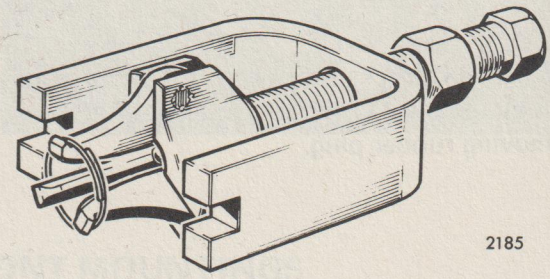
44 CYLINDER HEAD AND VALVES

The cylinder head has inclined valves that operate in renewable guides. The exhaust valves stems are capped with free-release type rotators which contact the valve spring retaining

collars. Clearance between the inner face of the rotator and the valve stem relieves the valve of spring pressure when it is lifted of its seat, allowing the valve to rotate. The valve rockers operate on a hollow shaft mounted on brackets and are positively lubricated via a drilling in the cylinder block and a cylinder head securing bolt. A reinforced asbestos gasket is used.

44a CYLINDER HEAD—Reconditioning

Use Remover VR2022 for withdrawal of cup plug. To facilitate removal, drive plug in slightly to break seal.
When installing, smear plug with sealing compound.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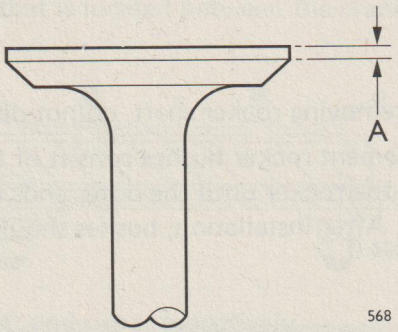
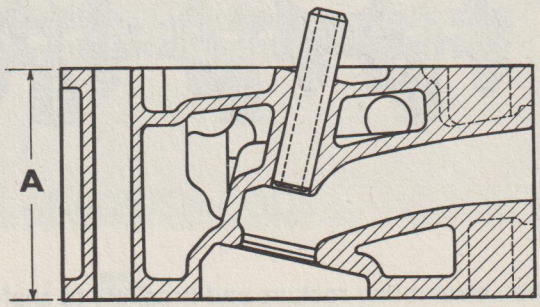


568

Renew a valve if thickness of head 'A', after refacing, is below specified minimum.

Exhaust valves have stellite facings which require a special grinding wheel for refacing.

Cylinder head may be refaced providing depth of head (dimension 'A') is not reduced below specified minimum.

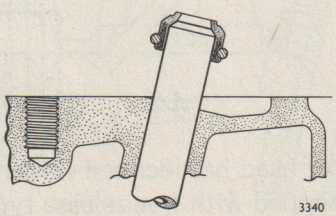


3342

When refacing head, contact surface must be ground-finished as cutter marks, however small, can be detrimental to gasket life.

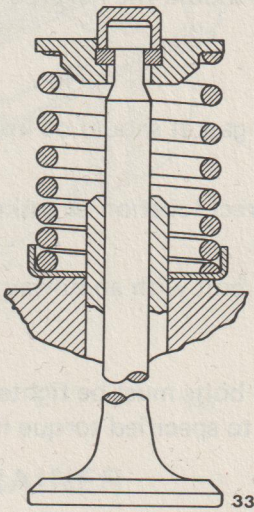
To renew a valve guide, drive out old guide with Remover Z8378 and press in new guide with Installer Z8406. The specified guide protrusion from head is obtained when installer contacts head.

If intake valve stem seals are used, secure with a circlip and smear lip of seals with oil.


3340

Before installing intake valves, remove burrs on valve stem groove to prevent damage to stem seal on valve assembly.

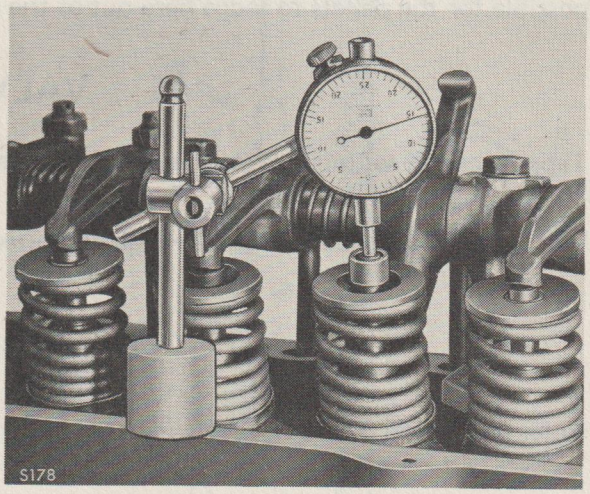
Lubricate valve stems with graphited oil and install valve springs with close coils adjacent to cylinder head.



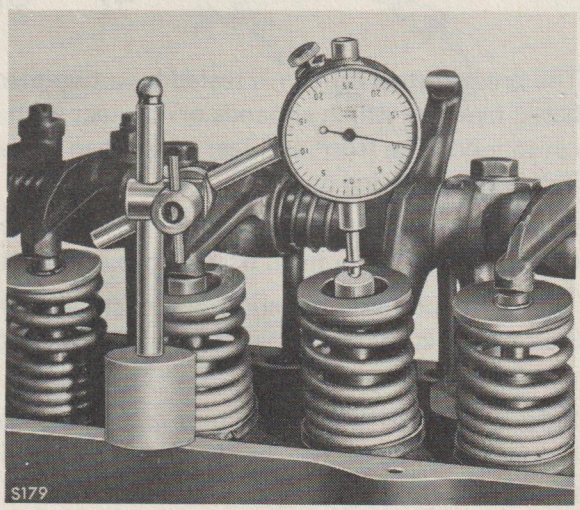
Arrangement of exhaust valve assembly with rotator cap.

Check the exhaust valve rotator caps as follows:

Clean inside of rotator cap and end of valve stem. Place cap upside down on end of stem.



Mount a dial gauge on cylinder head with gauge plunger located on recessed face of cap, avoiding dimple in centre of recess. Set gauge to zero.



Lift gauge plunger and reverse cap on valve stem to its assembled position taking care not to disturb gauge.

Check the reading of the gauge which represents the clearance existing between the cap and stem. If the clearance is not within the specified limits, repeat the test using a new cap and/or split collars. If the clearance is still not within the limits the valve must be renewed. Under no circumstances should the height of the cap be reduced.

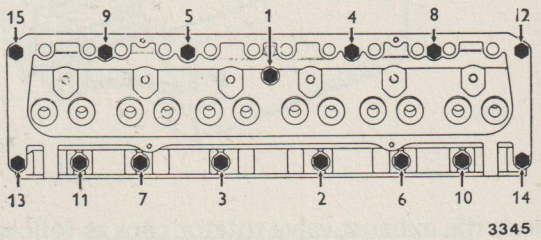
44b CYLINDER HEAD—Installation

Cylinder head gasket should be installed dry. Lightly lubricate cylinder head bolts with EP gear oil.

To ensure correct location of gasket, when installing cylinder head, use a guide stud at the front and rear.

Cylinder head bolt with an oilway through its centre locates in No. 3 bolt hole on push rod side.

Cylinder head bolts must be tightened gradually and evenly to specified torque in order shown.



Before connecting hose to thermostat housing, insert two pellets of Vauxhall Stop Leak in hose. D not introduce pellets through filler pipe where this is connected to the radiator bottom tank as it i possible for the pellets to lodge here out of the normal circulation of the coolant.

45 VALVE TAPPETS

Tappets can be withdrawn after removing rocker gear and push rod cover. Remove cover attachin bolts with Wrench D1095.

When installing tappets, lubricate with graphited oil to prevent scuffing on initial starting.

46 OIL FILTER

Refer to Section 8.

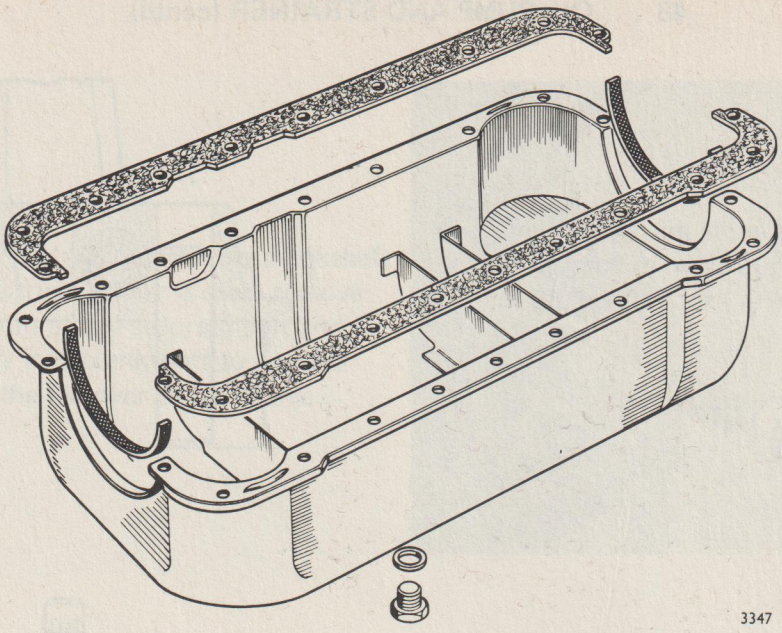
47 OIL PAN

The pressed steel oil pan is sealed by a two-piece gasket that is manufactured from an asbestos-based material which expands on contact with oil and must not be assembled with jointing compound. The front and rear of the pan is sealed by semi-circular cork seals located in grooves in the main bearing caps.

On installation, attach gaskets to crankcase flange with a smear of grease and ensure lip at end of gaskets locates in main bearing cap grooves before installing end seals.

The front and rear seals are supplied straight. Assembly can be simplified by pre-shaping the seals to the contour of the grooves by placing the seals for a short period round the inside of a warm piston.

Before installing end seals, smear groove in bearing cap with Wellseal jointing compound. Before installing oil pan, apply Bostik 771 to outside of seals especially at the junction of gasket and seal.

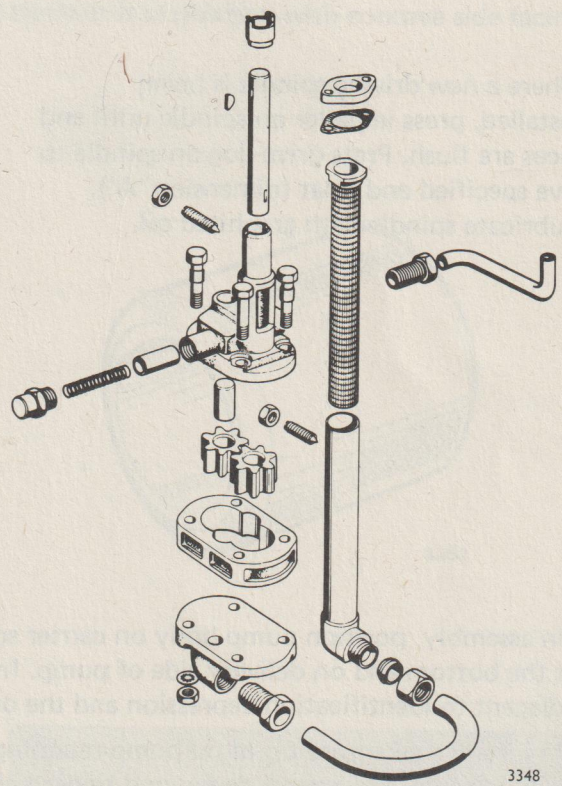


3347

48 OIL PUMP AND STRAINER

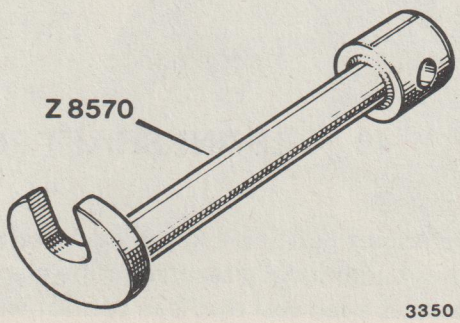
The gear-type oil pump, retained in the crankcase by an external setscrew and locknut, is driven by a dog-type collar engaged with the ignition distributor driving gear. The pump body incorporates a plunger-type pressure relief valve. Oil from the oil pan is drawn through a tubular gauze strainer located in a steel tube in the right-hand side of the crankcase and a suction pipe connected to the pump cover. Delivery of oil is via a pipe connected to a drilling in the crankcase then through a full-flow filter to the main gallery.

Pump can be withdrawn after disconnecting oil delivery pipe from crankcase and suction pipe from strainer, and slackening retaining setscrew on side of crankcase.



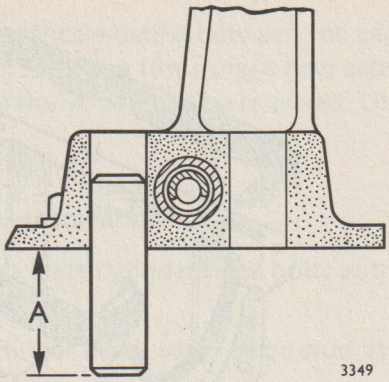
3348

Use Wrench Z8570 to disconnect oil delivery pipe.

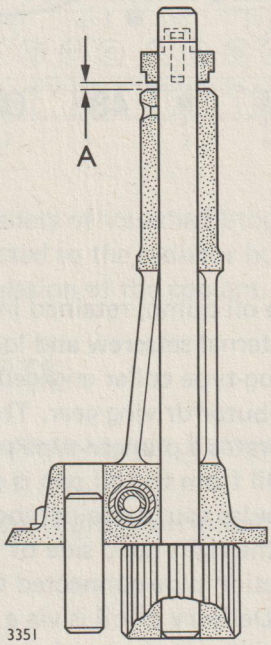


3350

Driven impeller spindle must be a tight fit in spindle carrier. Protrusion of spindle from body (dimension 'A') should be 1.10 in.



Where a new driving spindle is being installed, press impeller on spindle until end faces are flush. Press drive dog on spindle to give specified end float (dimension 'A'). Lubricate spindle with graphited oil.



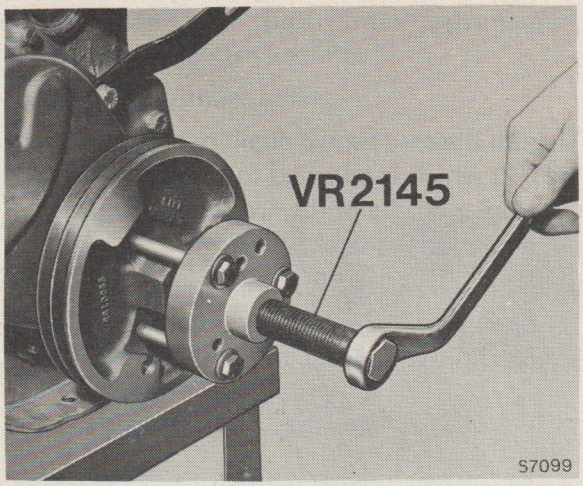
On assembly, position pump body on carrier so that identification depression in pump body is at the bottom and on delivery side of pump. Install one of the shouldered bolts in hole adjacent to identification depression and the other in the hole diagonally opposite.

On installation ensure tip of oil pump retaining screw enters the hole at top of spindle carrier. Tighten screw a quarter turn beyond finger tightness.

49 CRANKSHAFT PULLEY AND TIMING COVER

The crankshaft pulley is a keyed interference fit on the crankshaft spigot. When a triple pulley is used it is additionally secured to the crankshaft by a bolt and washer. The timing cover incorporates a felt seal that is in contact with the boss of the crankshaft pulley.

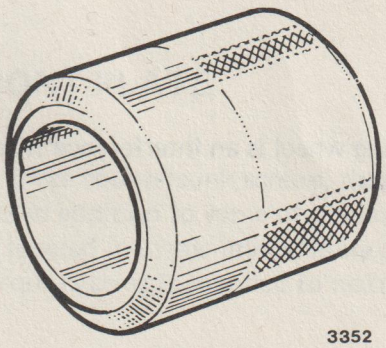
Use Remover VR2145 to withdraw crankshaft pulley. Where a triple pulley is used, remove plain washer from pulley securing bolt and install bolt fully into crankshaft to provide a platform for the remover thrust screw.



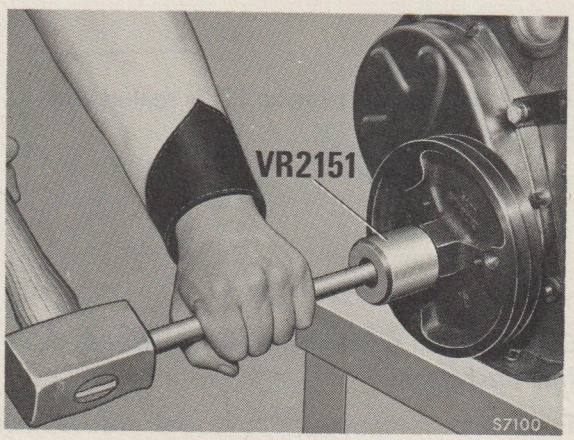
Soak timing cover seal in oil before installation.

Before installing cover check that crankshaft oil thrower is in position with concave side facing outwards.

Before tightening cover bolts, locate Aligner Z8560 on crankshaft spigot to engage and align oil seal concentric with pulley land.



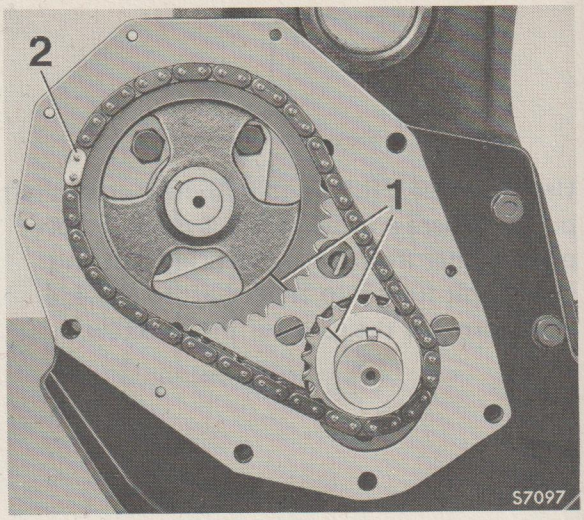
Drive crankshaft pulley into position using Installer VR2151 and a drift.



50 TIMING CHAIN

The double-row timing chain has a detachable link (2) which is polished for identification. Oil from a nozzle in the crankcase front plate lubricates the chain.

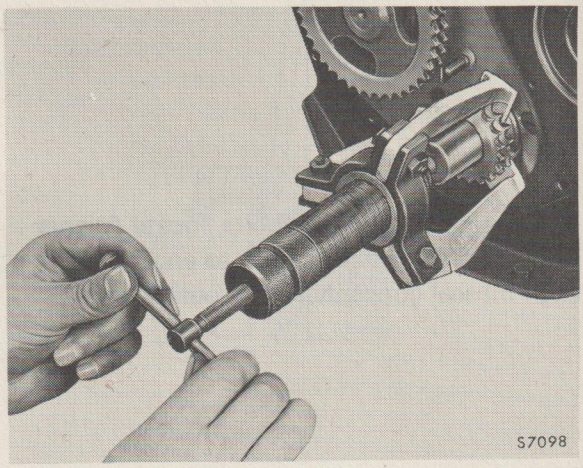
When installing chain, ensure timing marks (1) on wheels are in line and assemble link spring clip with its legs trailing.



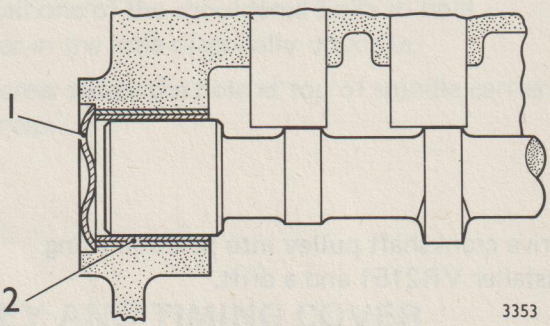
51 TIMING WHEELS AND CAMSHAFT

The camshaft is supported by four bearings in the crankcase and the tappets operate direct in the block. Camshaft end float is controlled by a thrust plate located behind the camshaft wheel and bolted to the cylinder block. The timing wheel is an interference fit on the camshaft.

The timing wheel is an interference fit on the crankshaft.



The camshaft rear bearing (2) is sealed with an expansion plug (1).



Camshaft can be removed complete with drive wheel after removing oil pump, tappets and fuel feed pump.

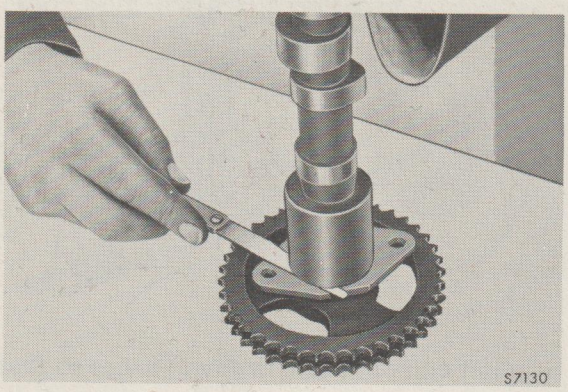
For access to tappets, remove push rods and side cover.

On Series E it is necessary to remove radiator support bracket from chassis frame crossmember and lower the engine to allow camshaft timing wheel to clear crossmember.

Withdraw camshaft carefully to avoid damage to bearings in cylinder block.

For camshaft bearing renewal, refer to Section 57a.

Timing wheel must be pressed on to camshaft so that clearance between front journal and thrust plate, representing camshaft end float, is within specified limits.



On reassembly, smear cams and tappets with graphited oil and assemble a new gasket to thrust plate.

52 CRANKCASE FRONT PLATE

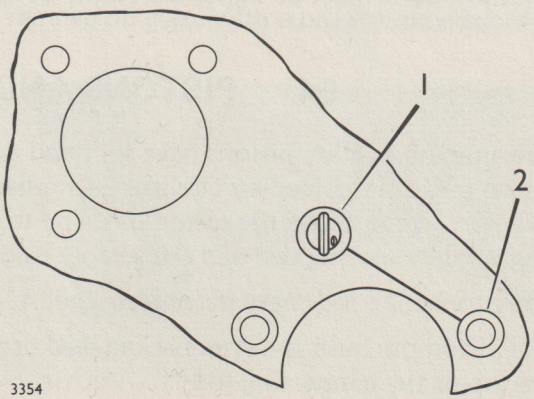
The crankcase front plate is secured to the crankcase by three countersunk screws, three hexagon-headed bolts and the camshaft thrust plate bolts in addition to some of the bolts securing the timing cover. The timing chain oil nozzle is located in a hole immediately above the aperture for the crankshaft. Oil from the camshaft front bearing is supplied to nozzle via a groove machined in the rear face of the front plate.

The gasket between the front plate and cylinder block is manufactured from an asbestos-based material which expands on contact with oil and must be assembled dry.

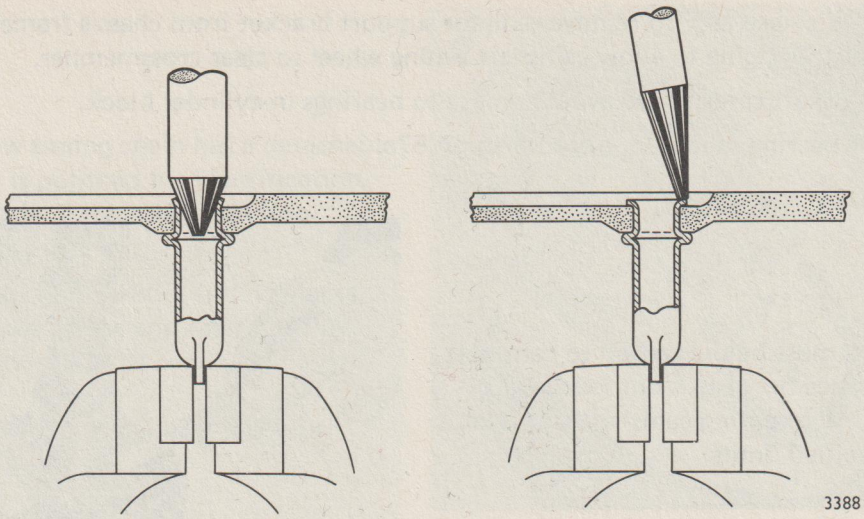
To install timing chain oil nozzle, proceed as follows:

Scribe a line on front plate between centre of oil nozzle attaching hole (1) and bolt hole (2).

Press nozzle into hole until annular ridge on nozzle contacts plate. Nozzle discharge hole must be aligned with scribed line on plate.



3354

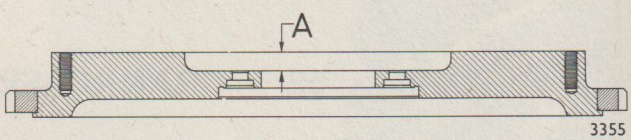


Grip flat end of nozzle firmly in a vice so that rear of plate is uppermost. Carefully expand hollow end of nozzle with a tapered punch (left) before staking the protruding hollow end firmly into plate groove with a flat end punch (right). Check nozzle alignment and ensure that staked end of nozzle is well below face of plate so that passage for oil is not obstructed.

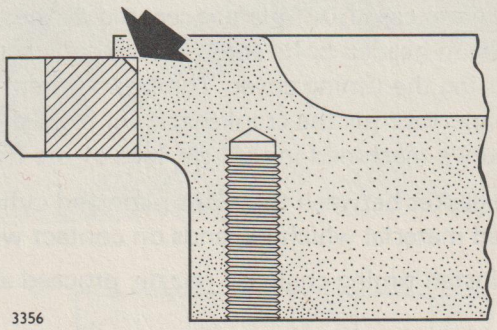
53 FLYWHEEL

The flywheel has a shrunk-on ring gear and two dowels protrude from the rear face for location of the clutch.

When refacing friction face, depth of flywheel at 'A' must not be reduced below 0.40 in. Friction face should be ground finished.



When installing a new ring gear, expand by heating to a temperature of 320° C (dark blue colour) and install gear with chamfered inner face towards flywheel flange.



Flywheel bolts must be tightened evenly to specified torque.

54 PISTONS AND CONNECTING RODS

The aluminium alloy pistons have split and oval ground tin-plated skirts and the fully floating piston pins are retained by circlips. Each piston carries three rings, two compression and one scraper, located above the piston pin. The top ring is chromium plated and tapered, the second ring is internally stepped and the scraper ring is of the steel rail type.

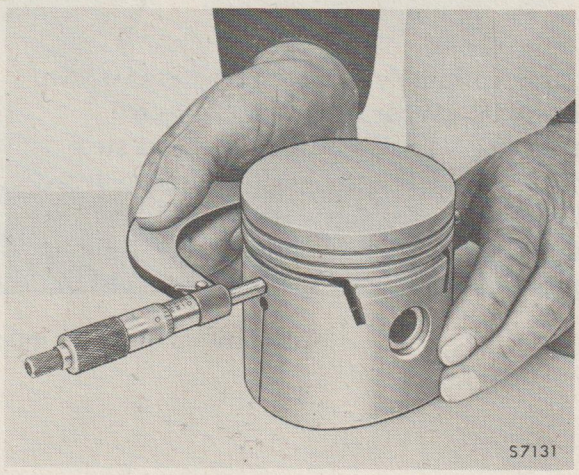
The connecting rods have detachable shell-type bearings with caps secured with nuts and bolts.

The piston pin bush is a steel-backed lead bronze type which is lubricated through a drilling in the top of the connecting rod.

54a PISTONS AND CONNECTING RODS—Removal and Inspection

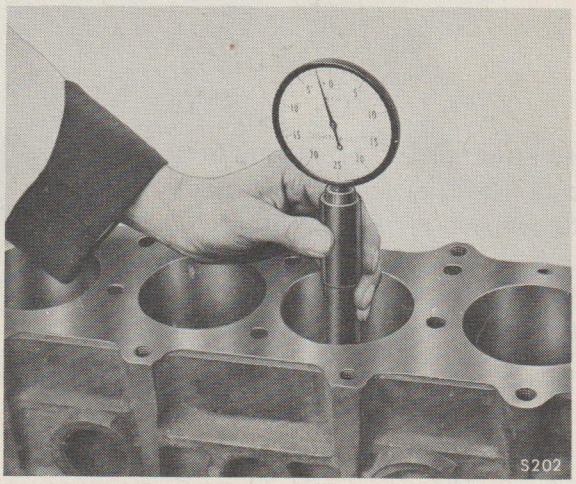
Piston and connecting rod must be withdrawn through top of cylinder block.

When assessing piston to cylinder bore clearance, and when reboring, maximum accuracy in piston and bore measurement is essential.



Piston size can be measured only at right-angles to piston pin and 0.10 in. below chamfer at top of skirt.

Micrometer spindle must turn freely so that it can be adjusted up to piston with a very light turning effort. If micrometer is adjusted to get a frictional feel over piston, it will indicate a dimension significantly smaller than the actual size.



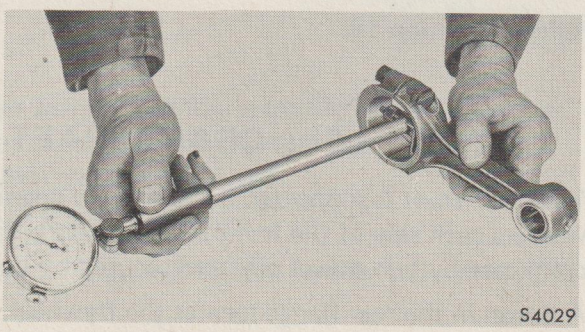
When checking cylinder bores it is not sufficiently accurate to take a direct reading from an inside micrometer. For maximum accuracy, a cylinder gauge should be used, in conjunction with the same micrometer as used for measuring piston. By this method, any discrepancy between individual micrometers is avoided.

Maximum piston oversize for engines with cylinder liners is 0.040 in.

For information on cylinder bore refinishing, refer to Section 57a.

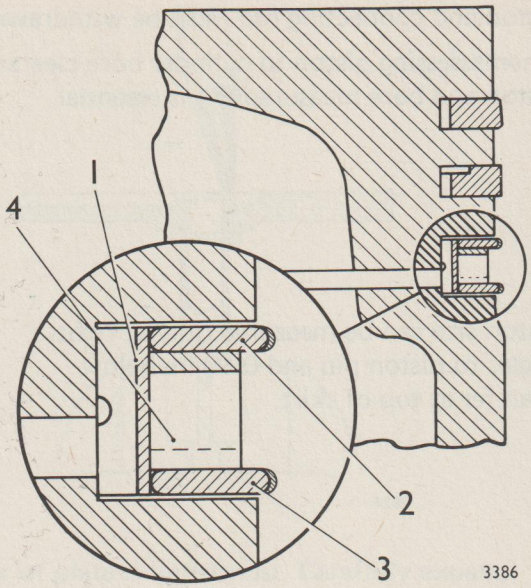
54b PISTONS AND CONNECTING RODS—Reassembly and Installation

Before installing new piston rings in a worn bore, remove oil glaze with a brush-type deglazer. This will facilitate bedding-in of rings.



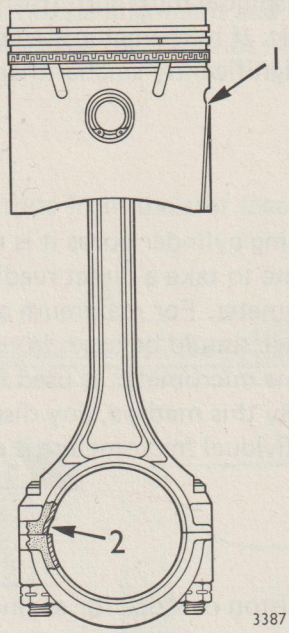
Before assembling rod to piston, check that bearing housing bore is within specified limits. This will determine whether cap has been filed.

Correct assembly of piston rings is as shown. To install scraper ring, assemble spring expander (1) in piston groove then a steel rail (3) against bottom land of groove. Insert spring spacer (4) above steel rail (3) and assemble steel rail (2) above spacer. Ring gaps must be equally spaced around piston.



3386

To assist correct installation of pistons in cylinder bores and correct assembly of caps to connecting rods, assemble all pistons to rods as in production-built engines, i.e. with split in piston skirt (1) away from machined slot (2) in rod for bearing locating lip.



3387

Install piston and connecting rod in cylinder bore with split in piston skirt facing away from camshaft.

55 ENGINE REMOVAL AND INSTALLATION

Refer to Section 18.

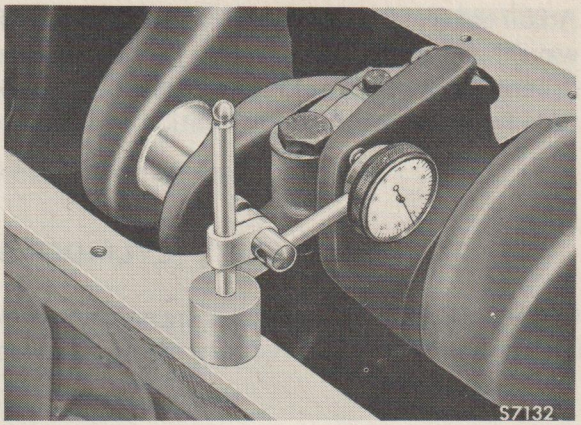
56 CRANKSHAFT AND MAIN BEARINGS

The crankshaft is supported by four main bearings and shaft end float is controlled by thrust washers each side of the front intermediate bearing. The main bearing caps are located in the crankcase by two dowel pins and secured by bolts and bi-hexagon lock plates.

A dowel in the rear flange locates the flywheel.

56a CRANKSHAFT AND MAIN BEARINGS—Removal and Reconditioning

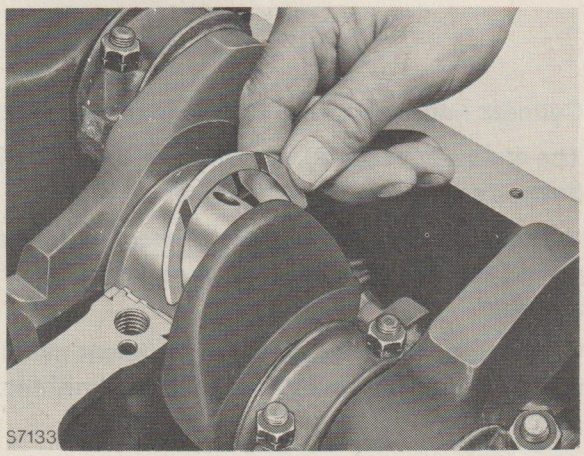
Before removing crankshaft during engine overhaul, check end float to determine if thrust washers on front intermediate bearing are worn. Oversize thrust washers are serviced.



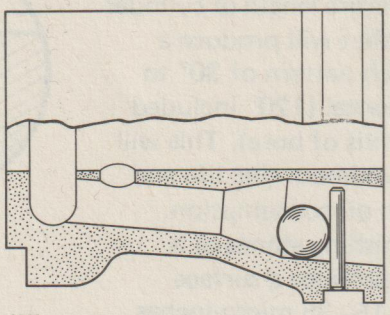
It is permissible to regrind crankshaft to a maximum of 0.040 in. undersize.

56b CRANKSHAFT AND MAIN BEARINGS—Installation

Crankshaft thrust washer oil grooves must face crankshaft thrust faces.



Before installing rear bearing cap ensure that the two steel balls move freely along the oil return drillings. This will ensure that balls will move to seal oil return drillings when vehicle is on a steep upward incline.



When installing front and rear bearing caps, smear sealing compound on threads of attaching bolts and on underside of bolt heads. Ensure that caps are seated on crankcase face before installing bolts otherwise sealer may exude between cap and crankcase.

Front bearing cap front face must align with front face of crankcase.

Tighten bearing cap bolts to specified torque and, if necessary, tighten further to locate locking plates.

57 CYLINDER BLOCK

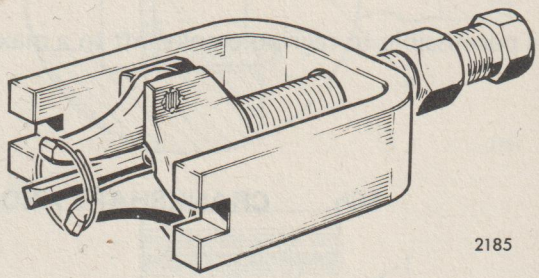
An oil gallery extends from front to rear of the cylinder block and is sealed by plugs. Oilways direct oil from the gallery to the crankshaft and camshaft bearings and a vertical drilling above the front intermediate bearing directs oil to the rocker gear. Two dowels protude from the rear face for location of the clutch housing.

57a CYLINDER BLOCK—Reconditioning

Cylinder block may be refaced by grinding providing depth of block, from top face to main bearing cap face, is not reduced below specified minimum.

Use Remover VR2022 for withdrawing cup plugs. To facilitate removal, drive plug inwards slightly to break seal.

When installing, smear periphery of plug with sealing compound.



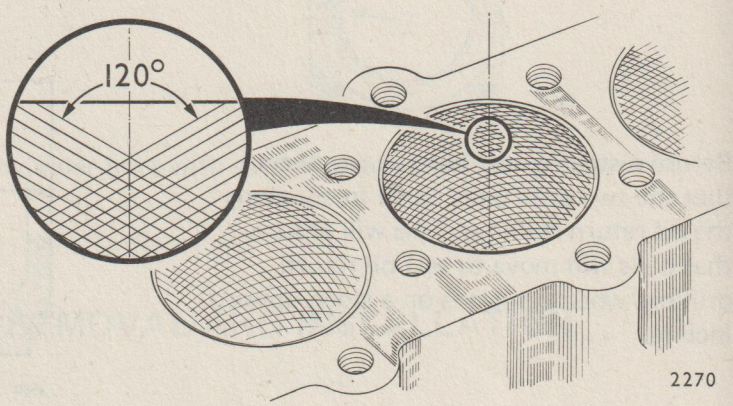
Cylinder liners are available. Maximum piston oversize with liners is 0.040 in.

The cut-away at the top of the liner should be ignored, as this is only required when these liners are used in an earlier engine.

Cylinder bores must be hone finished, with clean sharp stones of the proper grade for the required amount of metal to be removed. Dull or dirty stones cut unevenly and generate excessive heat.

When making initial cuts, leave sufficient metal so that all cutter or coarse stone marks may be removed with the fine stones used for finishing.

When finish honing, pass hone through entire length of cylinder at a rate that will produce a cross hatch pattern of 30° to the horizontal (120° included angle to axis of bore). This will ensure maximum ring life and minimum oil consumption. Select finishing stones of a grade to produce a surface finish of 15–35 micro-inches.



It is of greatest importance that refinished cylinder bores do not exceed 0.0005 in. out-of-round or taper.

Camshaft rear bearing expansion plug will be driven out during bearing removal.

When installing camshaft bearings, work in succession from the rear, and ensure that oil holes coincide with oilways in crankcase. Each bearing must be located so that notch is at top of housing and facing forward.

Rear bearing should be flush with front of bearing housing. Front bearing must not project beyond crankcase front face.

Replacement bearings are pre-finished to size and must be installed in sets to ensure bearing alignment.

Before installing rear bearing expansion plug, apply Loctite Grade AVV to periphery of plug for additional retention and sealing.

Ensure expansion plug does not project beyond machined rear face.

300 cu in. GASOLINE ENGINE

VALVE TIMING CHECK 102

VALVE CLEARANCE ADJUSTMENT 103

ENGINE MOUNTINGS 103

VALVE ROCKERS AND PUSH RODS 103

CYLINDER HEAD AND VALVES 103

VALVE TAPPETS 107

OIL FILTER 107

OIL PAN 107

OIL PUMP 107

CRANKSHAFT PULLEY AND TIMING COVER 107

CAMSHAFT 107

TIMING GEARS 108

AIR COMPRESSOR 108

TIMING CASE 108

FLYWHEEL 108

PISTONS AND CONNECTING RODS 108

ENGINE REMOVAL AND INSTALLATION 110

CRANKSHAFT, MAIN BEARINGS AND REAR SEAL 110

CYLINDER BLOCK 110

The 300 cu in. gasoline engine has a nominal bore and stroke of 3.875 in. and 4.25 in. respectively. The aluminium alloy pistons carry four rings, two compression rings and one scraper ring above the piston pin and one scraper ring below the pin. The pistons have split skirts and the fully-floating piston pins are retained by circlips.

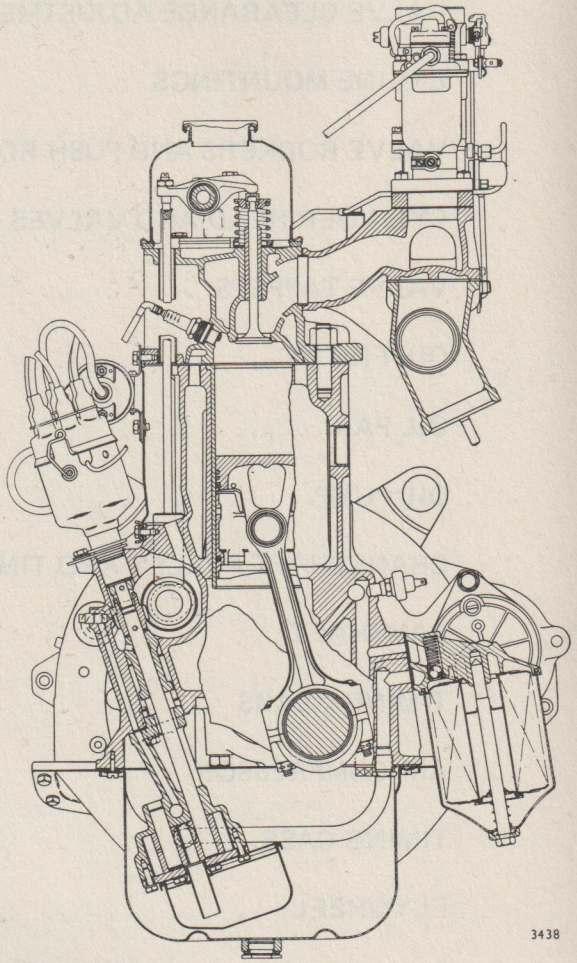
The crankshaft is supported by seven main bearings and shaft end float is controlled by thrust washers located on each side of the centre main bearing. A spring-loaded lip-type oil seal is provided at the front and a braided-fabric type at the rear. The crankshaft pulley incorporates a rubber-insert type vibration damper.

The camshaft is supported by four bearings, and is driven by a helical gear train from the crankshaft. An integral skew gear on the camshaft drives the oil pump and ignition distributor. Shaft end float is controlled by a thrust plate located behind the camshaft gear and bolted to the crankcase. The valves, carried in renewable guides, are operated via the rocker gear by tappets and push rods.

The gear-type oil pump is mounted in the right-hand side of the crankcase and its driving spindle is carried direct in the bore of the pump body.

The helical gear, keyed to the lower end of the shaft, meshes with a driven impeller which rotates on a spindle in the pump body. Oil is fed via a full flow filter to the main gallery and through drillings in the cylinder block to the crankshaft and camshaft. Lubrication of the timing gears is by a jet of oil from the front main bearing. The valve rockers are lubricated via an oil feed pipe located in a cylinder head drilling which corresponds with an oil passage in the cylinder block.

Crankcase ventilation is effected by air drawn by manifold depression through hoses connected between a ventilator valve in the intake manifold and the push rod cover, and the rocker cover and the carburetter.



58 VALVE TIMING CHECK

Valve timing can be checked by the following method, without removing the timing cover:

(a) Remove the flywheel underpan and mark the flywheel on the 36th tooth from the U/C mark, counting in the opposite direction of engine rotation.

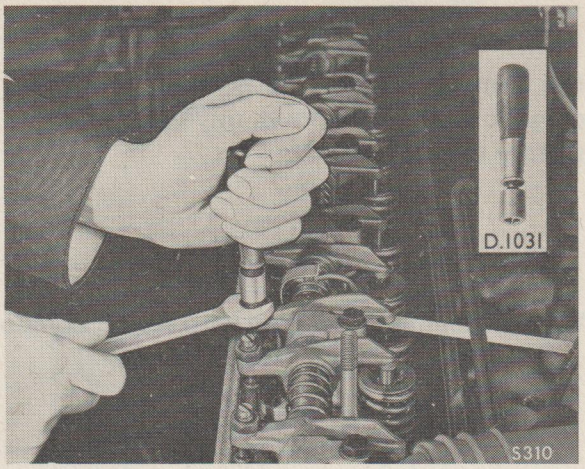
(b) Mount a dial gauge over No. 1 intake valve (on some engines it is more convenient to use the intake valve of the rear cylinder) with gauge plunger contacting spring cap.

(c) Turn the engine in the normal direction of rotation until, by observing the gauge, the intake valve is seen to be fully open. At this point, the mark made on the flywheel should coincide with the pointer in the timing aperture in the clutch housing.

A discrepancy of 4 to 5 teeth on the flywheel ring gear indicates a one tooth error in valve timing. A discrepancy of 1 to 4 teeth on the flywheel ring gear indicates excessive gear backlash or wear in the keyways of the crankshaft or crankshaft gear, or of the key itself.

59 VALVE CLEARANCE ADJUSTMENT

Valve clearance should be checked and adjusted with engine idling at operating temperature. Use Adjuster D1031 to turn adjusting screw.



60 ENGINE MOUNTINGS

The engine mountings are similar to those described for the 330 cu in. diesel engine in Sections 3 and 4.

61 VALVE ROCKERS AND PUSH RODS

The valve rockers and push rods are similar to those described for the 330 cu in. diesel engine in Section 5.

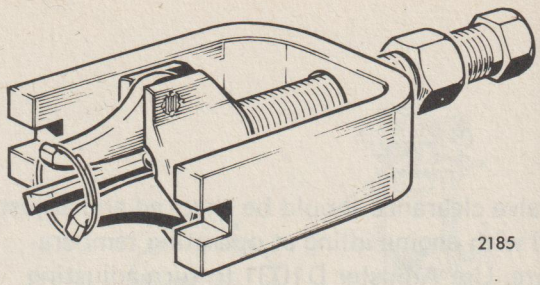
62 CYLINDER HEAD AND VALVES

The cylinder head is secured to the cylinder block by studs and nuts. The valves operate in renewable guides and the exhaust valve stems are capped with free-release type rotators which contact the valve spring retaining collars. Clearance between the inner face of the rotator and the valve stem relieves the valve spring of pressure when it is lifted off its seat, allowing the valve to rotate. The valve rockers operate on a hollow shaft mounted on brackets and are positively lubricated via a drilling in the cylinder block and head. A gasket of asbestos, sandwiched between a sheet of copper and of steel, is used.

62a CYLINDER HEAD — Removal and Reconditioning

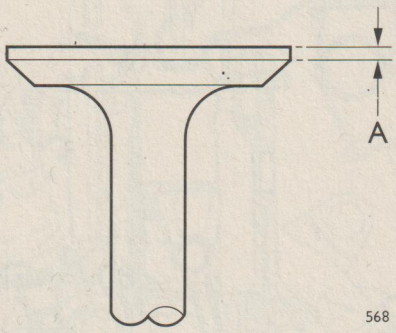
Do not drag cylinder head across securing studs otherwise head face may be irreparably damaged.

Use Remover VR2022 for withdrawal of cup plug. To facilitate removal, drive plug in slightly to break seal.



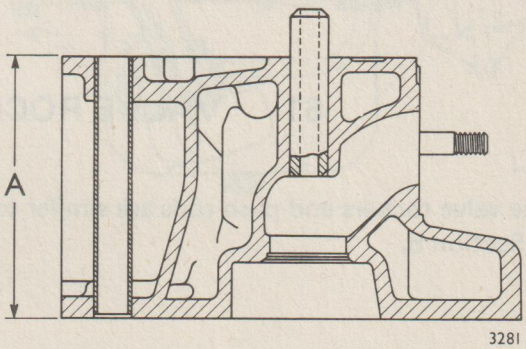
When installing, smear plug with sealing compound.

Renew a valve if thickness of head 'A', after refacing, is below specified minimum.



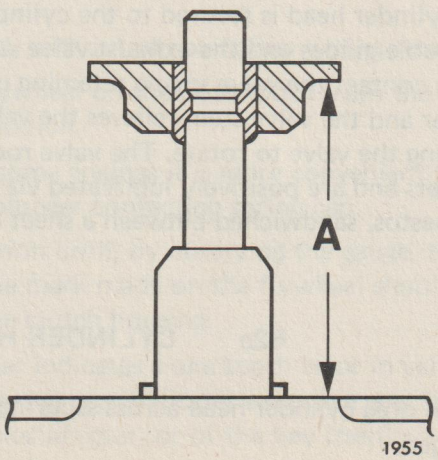
Some engines have exhaust valves with stellite facings which require a special grinding wheel when refacing.

Cylinder head may be refaced providing depth of head (dimension 'A') is not reduced below specified minimum.

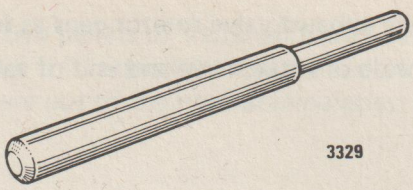


When refacing head, contact surface must be ground-finished as cutter marks, however small, can be detrimental to gasket life.

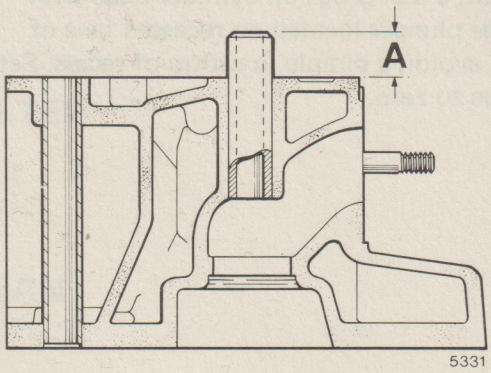
After refacing valve seatings in cylinder head, assemble valve spring cap and split collars and check that height from cylinder head to underside of cap (dimension 'A') does not exceed specified valve spring assembled height. If this height is exceeded when measured with a new valve, seating is too deep and cylinder head is unfit for further service.



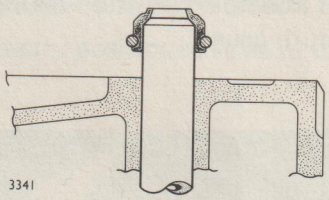
To renew a valve guide, drive out old guide with Remover Z8378.



Press in new valve guide to give specified height (dimension 'A') above head.



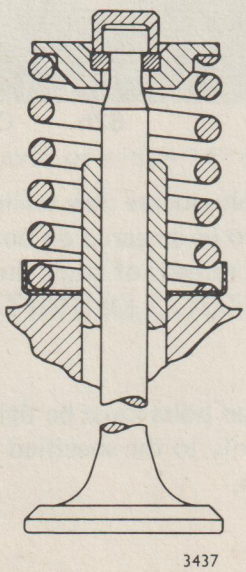
If intake valve stem seals are used, secure with a circlip and smear lip of seals with oil.



Before installing intake valves, remove burrs on valve stem groove to prevent damage to stem seal on valve assembly.

Lubricate valve stems with graphited oil.

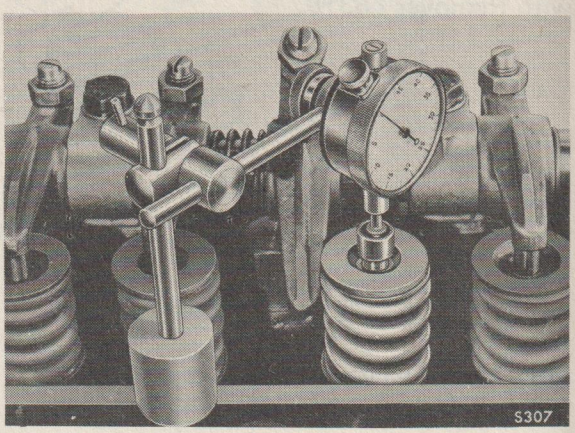
Arrangement of exhaust valve assembly with rotator cap.



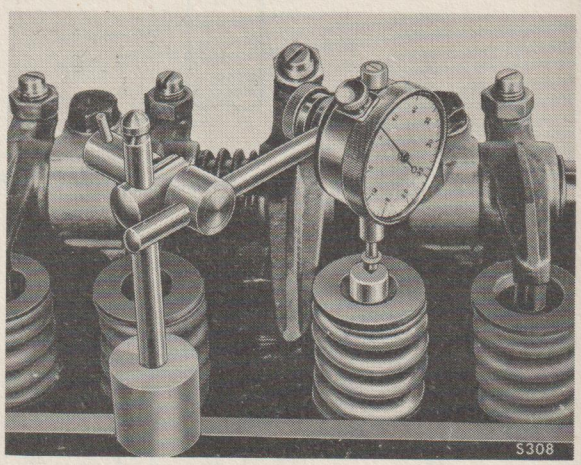
Check the exhaust valve rotator caps as follows:

Clean inside of rotator cap and end of valve stem. Place cap upside down on end of stem.

Mount a dial gauge on cylinder head with gauge plunger located on recessed face of cap, avoiding dimple in centre of recess. Set gauge to zero.



Lift gauge plunger and reverse cap on valve stem to its assembled position taking care not to disturb gauge.

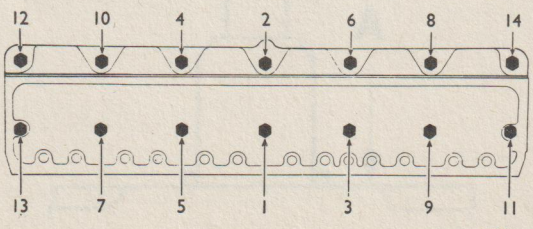


Check the reading of the gauge which represents the clearance existing between the cap and stem. If the clearance is not within the specified limits, repeat the test using a new cap and/or split collars. If the clearance is still not within the limits the valve must be renewed. Under no circumstances should the height of the cap be reduced.

62b CYLINDER HEAD—Installation

On reassembly, locate new sealing rings in water ports at rear of cylinder block. Cylinder head gasket should be smeared on both sides with Wellseal jointing compound. Cylinder head nut washers and threads of studs should be smeared with grease.

Cylinder head bolts must be tightened gradually and evenly to the specified torque in the order shown.



1796

Before connecting hose to thermostat housing, insert two pellets of Vauxhall Stop Leak in hose. Do not introduce pellets through filler pipe where this is connected to the radiator bottom tank as it is possible for the pellets to lodge here out of the normal circulation of the coolant.

63 VALVE TAPPETS

Refer to Section 7.

64 OIL FILTER

Refer to Section 8.

65 OIL PAN

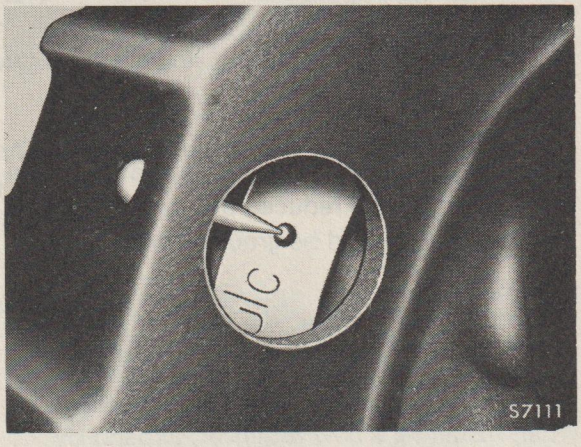
Refer to Section 9.

66 OIL PUMP

The oil pump is similar to that described for the 220 and 330 cu in. diesel engine in Section 10.

To ensure that the pump drive gear offset dogs will be correctly positioned relative to the ignition distributor drive install pump as follows:

Align timing ball in flywheel with pointer in timing aperture with No. 1 cylinder on compression stroke.



Install pump with driving gear dogs at right-angles to camshaft axis, or within 14° clockwise of this position, with the dogs offset towards rear of engine.

67 CRANKSHAFT PULLEY AND TIMING COVER

Refer to Section 11.

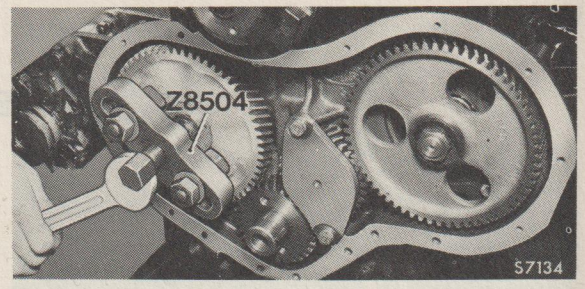
68 CAMSHAFT

Refer to Section 12.

69 TIMING GEARS

The timing gears are similar to those described for the 220 and 330 cu in. diesel engines in Section 13 except that the camshaft drive gear is made of aluminium alloy.

Use Remover Z8504 for removing camshaft gear.



70 AIR COMPRESSOR

Refer to Section 14.

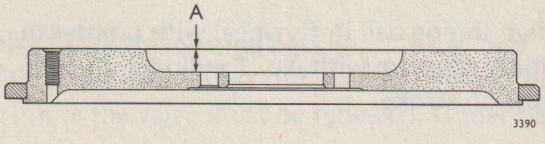
71 TIMING CASE

Refer to Section 15.

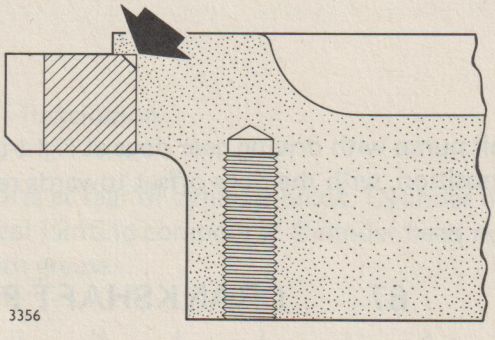
72 FLYWHEEL

The flywheel has a shrunk-on ring gear and two dowels protrude from the rear face for location of the clutch.

When refacing friction face, depth of flywheel at 'A' must not be reduced below 0.62 in. Friction face should be ground finished.



When installing a new ring gear, expand by heating to a temperature of 320°C (dark blue colour) and install gear with chamfered inner face towards flywheel inner face.



Flywheel bolts must be tightened evenly to specified torque.

73 PISTONS AND CONNECTING RODS

The aluminium alloy pistons have split and oval ground tin-plated skirts and the fully-floating

piston pins are retained by circlips. Each piston carries four rings, two compression rings and one scraper ring above the piston pin and one scraper ring below the pin. The top ring is chrome plated and tapered. The second ring is internally stepped. The scraper rings are of the slotted type.

The connecting rods have detachable shell-type bearings with caps secured with nuts and bolts.

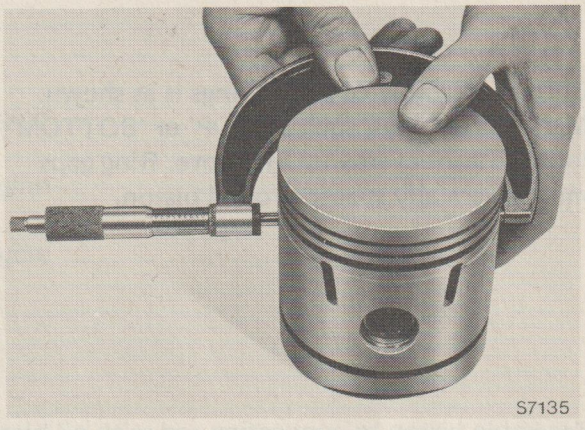
The piston pin bush is of lead-bronze and lubricated through a drilling in the top of the connecting rod.

73a PISTONS AND CONNECTING RODS—Removal and Installation

Piston and connecting rod must be withdrawn through top of cylinder block.

When assessing piston to cylinder bore clearance, and when reboring, maximum accuracy in piston and bore measurement is essential.

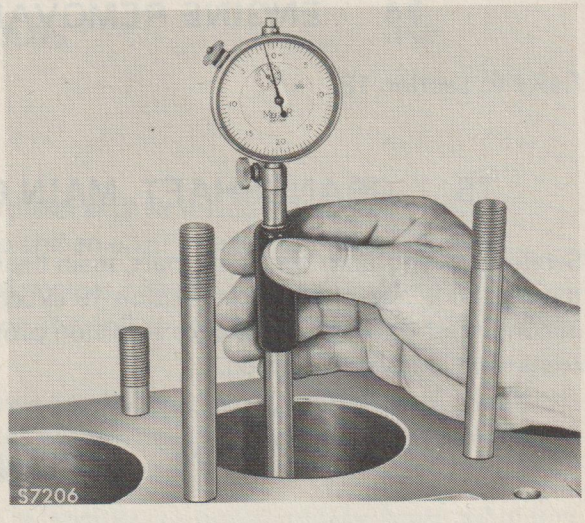
Piston size can be measured only at right-angles to piston pin and 0.10 in. below chamfer at top of skirt.


S7135

Micrometer spindle must turn freely so that it can be adjusted up to piston with a very light turning effort. If micrometer is adjusted to get a frictional feel over piston, it will indicate a dimension significantly smaller than the actual size.

When checking cylinder bores it is not sufficiently accurate to take a direct reading from an inside micrometer. For maximum accuracy, a cylinder gauge should be used, in conjunction with the same micrometer as used for measuring piston.

By this method, any discrepancy between individual micrometers is avoided.

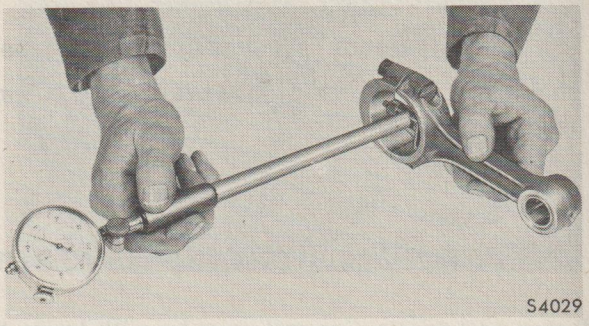

S7206

Maximum piston oversize for engines with cylinder liners is 0.020 in.

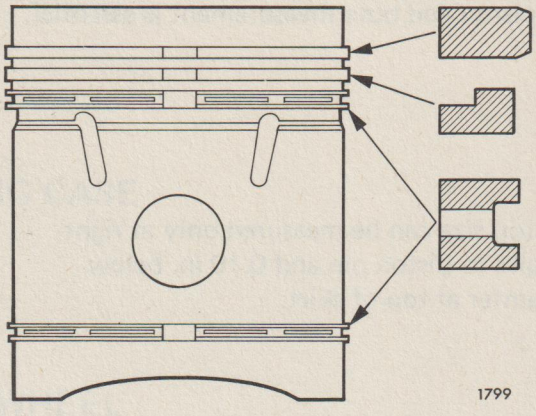
For information on cylinder bore refinishing, refer to Section 20a.

Before installing new piston rings in a worn bore, remove oil glaze with a brush-type deglazer. This will facilitate bedding-in of rings.

Before assembling rod to piston, check that bearing housing bore is within specified limits. This will determine whether cap has been filed.


S4029

Correct assembly of piston rings is as shown. Markings on rings, such as 'TOP' or 'BOTTOM', indicate correct way up in groove. Ring gaps must be equally spaced around piston.


1799

Assemble piston to connecting rod with oil bleed hole in rod on opposite side to split in piston skirt.

Install piston and connecting rod in cylinder bore with split in piston skirt facing away from camshaft.

74 ENGINE REMOVAL AND INSTALLATION

Refer to Section 18.

75 CRANKSHAFT, MAIN BEARINGS AND REAR SEAL

Service procedure for the crankshaft, main bearings and rear seal is similar to that described for the 330 cu in. diesel engine in Section 19 except that the crankshaft can be reground to a maximum of 0.040 in. Reference to piston protrusion when installing a replacement or reground crankshaft should be ignored.

76 · CYLINDER BLOCK

Service procedure for the cylinder block is similar to that described for the 330 cu in. diesel engine in Section 20 except that the cylinder block may be refaced by grinding, providing depth of block, i.e. top face to oil pan face, is not reduced below specified minimum.

FUEL AND EXHAUST—Diesel Engines

FAULT DIAGNOSIS 112

PRECAUTIONS IN SERVICE 114

ACCELERATOR PEDAL LINKAGE 114

PRIMARY FUEL FILTER 115

FUEL SYSTEM SEDIMENT TRAP 116

MAIN FUEL FILTER 116

HEAVY-DUTY FUEL FILTRATION 117

AIR CLEANER 118

HEAVY-DUTY AIR FILTRATION 119

COLD-STARTING AID 120

FUEL FEED PUMP—220 cu in. Engine 122

FUEL FEED PUMP—330 cu in. Engine 124

FUEL FEED PUMP—466 cu in. Engine 125

FUEL INJECTION PIPES 128

INJECTORS 129

FUEL INJECTION PUMP—220 cu in. Engine 135

FUEL INJECTION PUMP—330 cu in. Engine 140

FUEL INJECTION PUMP—466 cu in. Engine 145

INTAKE AND EXHAUST MANIFOLDS 150

The fuel system of the 220, 330 and 466 cu in. diesel engines includes a chassis-mounted sediment trap, a diaphragm-type fuel feed pump and an engine mounted main fuel filter.

The main fuel filter on 220 and 330 cu in. diesel engines comprises a head, a disposable paper-type element and a base. The main filter on the 466 cu in. engine is similar but with an enlarged base which forms a sediment chamber.

A 330 cu in. engine with heavy-duty fuel filtration incorporates a large base filter between the fuel feed pump and the main filter. On 466 cu in. engines the large base filter is supplemented by a small base filter under a common filter head.

The Simms fuel injection pump used on 220 cu in. engines is a pneumatically-governed in-line unit which incorporates an excess fuel device to facilitate cold starting.

On 330 cu in. engines, a CAV hydraulically-governed distributor-type injection pump is used.

On the three power variants of the 466 cu in. engines, the CAV mechanically-governed distributor-type injection pumps are similar except for specifications.

On engines with distributor-type pumps a cold-starting aid comprising an igniter supply tank, switch and an igniter is used.

The multi-hole injectors are located in renewable sleeves in the cylinder head and project into combustion chambers in the piston crowns.

An oil-bath type air cleaner is used on 220 and 330 cu in. engines. On 466 cu in. engines, a paper element type cleaner is incorporated in the intake manifold.

Heavy-duty air filtration is available on some Series E trucks powered by a 330 or 466 cu in. engine. This equipment comprises a cab-mounted large capacity paper-element filter used in conjunction with twin centrifugal cleaners attached to the rear of the cab.

77 FAULT DIAGNOSIS

Uneven Running and Misfiring

Air leak on suction side of fuel system
Water in fuel system
Blow past injector seating washers
Injectors of incorrect type or despatch number
Injectors require servicing
Restriction in injection pipes due to incorrect installation
Fuel injection pump coupling or pump attaching bolts loose
Fuel injection pump to engine timing incorrect

Incorrect Engine Idling and Maximum Speeds

Idling and maximum speed stop screws incorrectly adjusted
Anti-stall screw on CAV mechanically governed pump incorrectly adjusted
Accelerator pedal linkage maladjusted
Fuel injection pump speed control lever loose on spindle
Fuel filter/s require servicing
Operation or delivery pressure of fuel feed pump incorrect
Fuel pipes obstructed
Air cleaner element/s require servicing
Governor spring incorrectly fitted on CAV mechanically-governed pump
Blow past injector seating washers
Fuel injection pump to engine timing incorrect
CAV pump timing circlip incorrectly positioned

Engine Stalls

Idling speed stop screw incorrectly adjusted
Anti-stall screw on CAV mechanically governed pump incorrectly adjusted
Fuel injection pump timing incorrect
CAV pump timing circlip incorrectly positioned
Filter and sediment trap sealing rings incorrectly located
Fuel feed pump delivery pressure incorrect
Fuel injection pump governor linkage worn
Wire to automatic fuel shut-off valve disconnected

Lack of Power

Water and foreign matter in fuel filter and/or sediment trap
Fuel feed pump delivery pressure incorrect
Leak-off pipes obstructed
Fuel tank vent obstructed
Exhaust system restricted
Air cleaner element/s require servicing
Accelerator pedal linkage maladjusted
Injectors of incorrect type or despatch number
Injectors require servicing
More than one seating washer used on an injector
Fuel injection pump to engine timing incorrect
CAV pump timing circlip incorrectly positioned
Simms fuel injection pump spill timing incorrect
Pump maximum speed adjustment incorrect
Speed control lever loose on spindle
Incorrect fuel injection pump fitted

Engine Knocks

Fuel injection pump to engine timing incorrect
CAV pump timing circlip incorrectly positioned
Injectors require servicing
Fuel injection pump requires calibrating

Engine Loses Power and Stops

Empty fuel tank
Air leak on suction side of fuel system
Fuel filter/s require servicing
Fuel tank vent obstructed
Fuel injection pump leak-off pipe obstructed
Fuel feed pump delivery pressure incorrect
Wire to automatic fuel shut-off valve disconnected

Excessive Exhaust Smoke

Air cleaner element/s require servicing
Cold starting aid igniter leaking
Blow past injector seating washers
Injectors of incorrect type or despatch number
Injectors require servicing
More than one seating washer used on an injector
Incorrect injection pump to engine timing
CAV pump timing circlip incorrectly positioned
Incorrect fuel injection pump installed

78 PRECAUTIONS IN SERVICE

It is essential that precautions are taken to prevent the ingress of dirt into the fuel system when parts of the system are disassembled.

Before disconnecting pipes the area in the vicinity of the pipe unions must be cleaned, and after removal, both ends of a pipe must be plugged.

Fuel injector and injection pump orifices must be sealed when injection pipes are removed.

Injectors should not be disassembled unless a clean dust free room equipped with cleaning and testing equipment is available and provided with a filtered supply of Shell Calibration Fluid C or equivalent. Benches should be linoleum covered.

79 ACCELERATOR PEDAL LINKAGE

Accelerator pedal linkage used with a 220 cu in. engine should be adjusted so that the air venturi butterfly valve is in the fully open position with the accelerator pedal approximately 0.80 in. from the toe panel. On Series E trucks the dimension is taken from the bottom of the pedal stop pad.

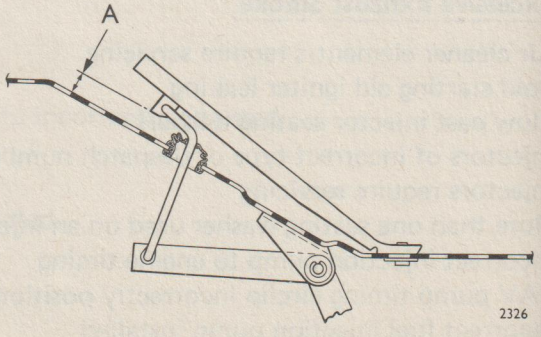
Accelerator pedal linkage used with a 330 cu in. engine should be adjusted so that the speed control lever on the fuel injection pump is in the maximum speed position, when the accelerator pedal is 0.50 in. above the toe panel or pedal stop.

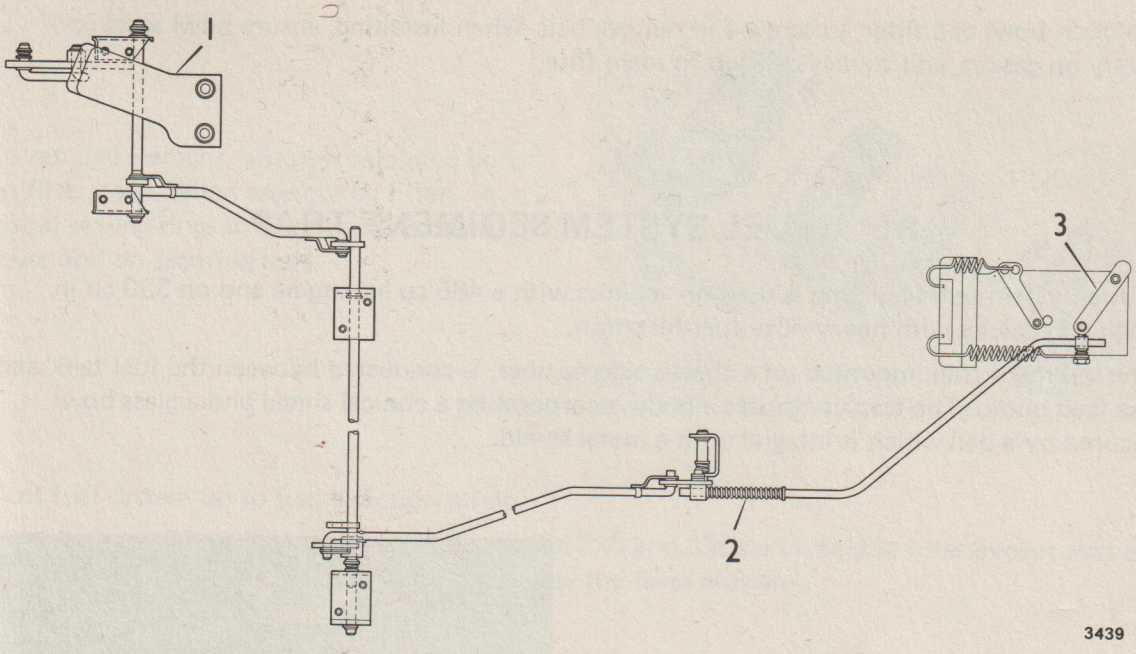
Adjustment of the linkage is achieved by varying the length of the rod through the control rod swivel.

After adjustment, check that the control rod over-ride spring is not coil bound when accelerator pedal is fully depressed, otherwise undue strain will be placed on pump.

On Series C trucks with a 330 cu in. engine, pump control lever is correctly positioned on its spindle when pointing upwards to the rear at approximately 45° when in maximum speed position. On other models lever should point downwards at the front at 45°. The lever position can be adjusted in steps of 1½° after slackening securing bolt. Normal position of control rod is in second hole from outer end of throttle lever.

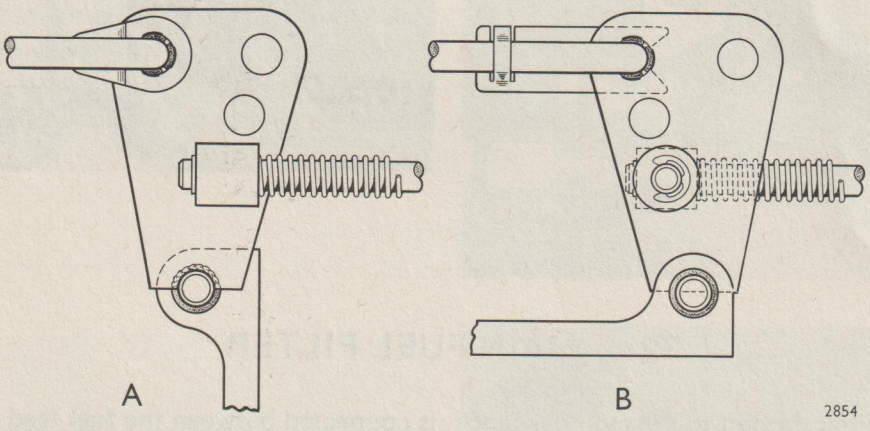
Accelerator pedal linkage used with a 466 cu in. engine should be adjusted so that injection pump control lever is in maximum speed position when accelerator pedal is 0.80 in. above toe panel (dimension 'A'). On YRQ and YRT coaches, accelerator pedal should be 1.10 in. above stop bracket on toe panel. To adjust linkage, reposition control rod swivel on injection pump control rod.





3439

Fully depress accelerator pedal (1) and check that pump control (3) is in maximum speed position and that over-ride spring (2) is not coil bound. If necessary, reposition control rod in control lever swivel.

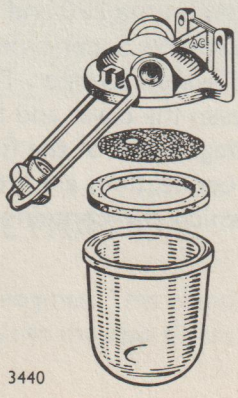


2854

On models with a relay lever, the accelerator pedal rod and pump control rod should be connected as shown at (A) for EPR and ERT models, and as shown at (B) for ERV, HRX and YRT models.

80 PRIMARY FUEL FILTER

220 and 330 cu in. diesel-engined vehicles are provided with a glass bowl gauze-type primary filter mounted on the chassis frame between the fuel tank and main filter.


3440

80 PRIMARY FUEL FILTER (contd)

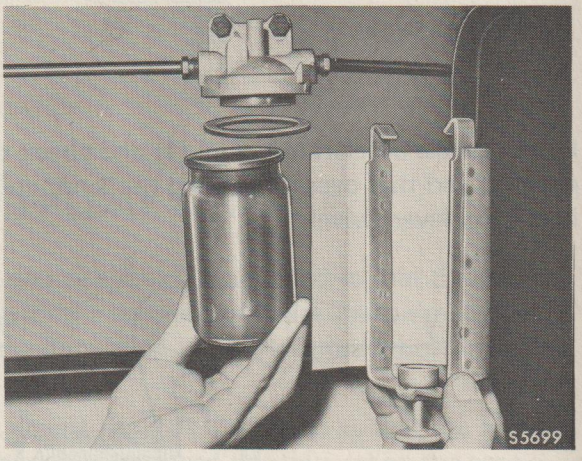
To clean bowl and filter, unscrew and remove bail. When installing, ensure bowl seats correctly on gasket, and vent system up to main filter.

81 FUEL SYSTEM SEDIMENT TRAP

A fuel system sediment trap is used on vehicles with a 466 cu in. engine and on 330 cu in. engined vehicles with heavy-duty fuel filtration.

The sediment trap, mounted on a chassis sidemember, is connected between the fuel tank and the feed pump. The trap comprises a body incorporating a conical shield and a glass bowl secured by a bail which is integral with a metal shield.

To clean bowl, unscrew and remove bail. When installing, ensure bowl seats correctly on gasket, and vent fuel system up to main filter.

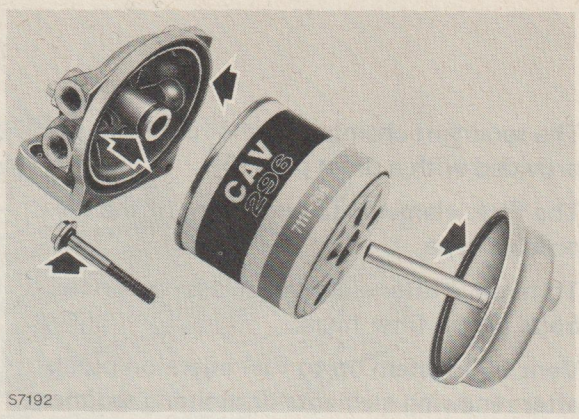


82 MAIN FUEL FILTER

A main fuel filter, bolted to the cylinder block, is connected between the fuel feed and injection pumps.

The filter installed on the 220 and 330 cu in. engines has a disposable paper-type element contained within a steel canister. The canister is clamped between the cover and the base and forms an integral part of the filter. Inlet and outlet pipe connections are provided in the filter head which also contains an air vent connection.

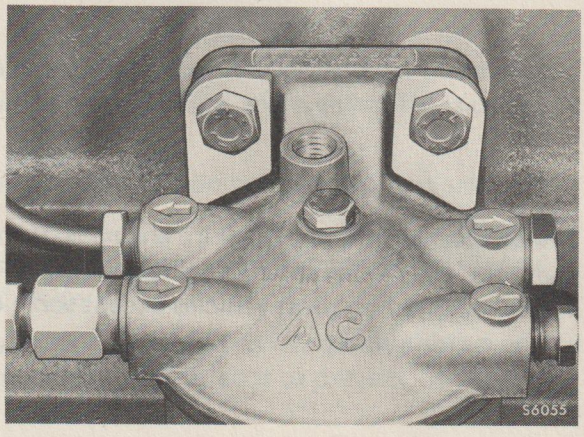
To remove element, unscrew retaining bolt on filter head. When assembling filter, install sealing rings in filter head, bottom cover and on securing bolt.



Vent fuel system up to fuel injection pump.

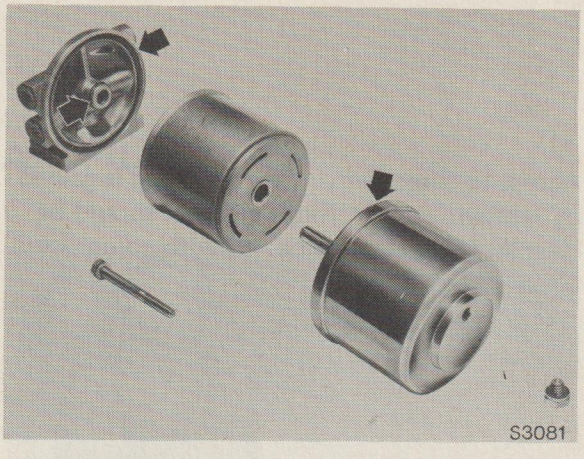
The filter on 466 cu in. engines is similar to the 220 and 330 cu in. engine filter except that a sediment trap with a drain plug is located below the filter element.

Clamping plates are used under the heads of the attachment bolts to support the flange. A non-return valve is installed in the left-hand inlet port to prevent fuel flowing through the fuel injection pump leak-off pipe in the wrong direction.



To remove element or sediment chamber unscrew retaining bolt on filter head. When assembling filter, install sealing rings (arrowed) in filter head, sediment chamber and on securing bolt.

Vent fuel system up to fuel injection pump.



83 HEAVY-DUTY FUEL FILTRATION

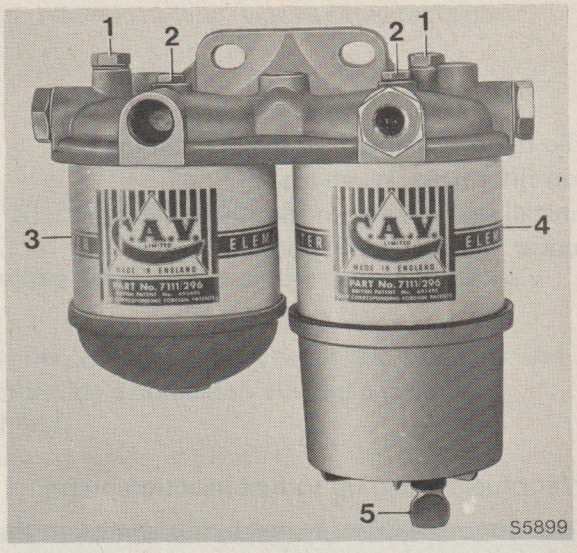
Heavy-duty fuel filtration is available on 330 and 466 cu in. engines. This comprises two filters in series, one filter having a sediment trap. On 466 cu in. engines the two filters are mounted on a common head.

The sediment chamber of the first filter is provided with a drain plug (5).

The filter elements (3 and 4) are of the disposable type.

To remove filter elements release retaining bolts (2) on filter head.

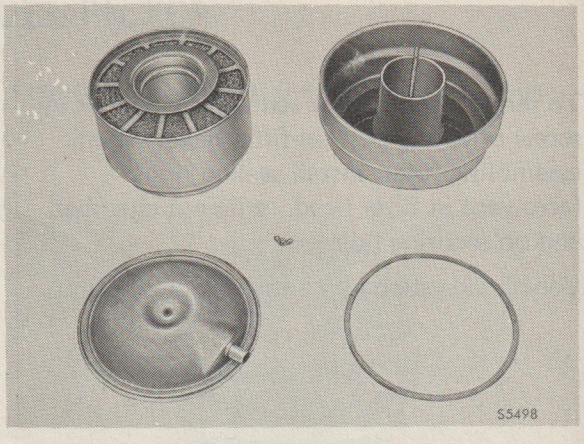
Vent fuel system up to fuel injection pump after renewing elements or draining sediment chamber. Two vent plugs (1) are provided.



84 AIR CLEANER

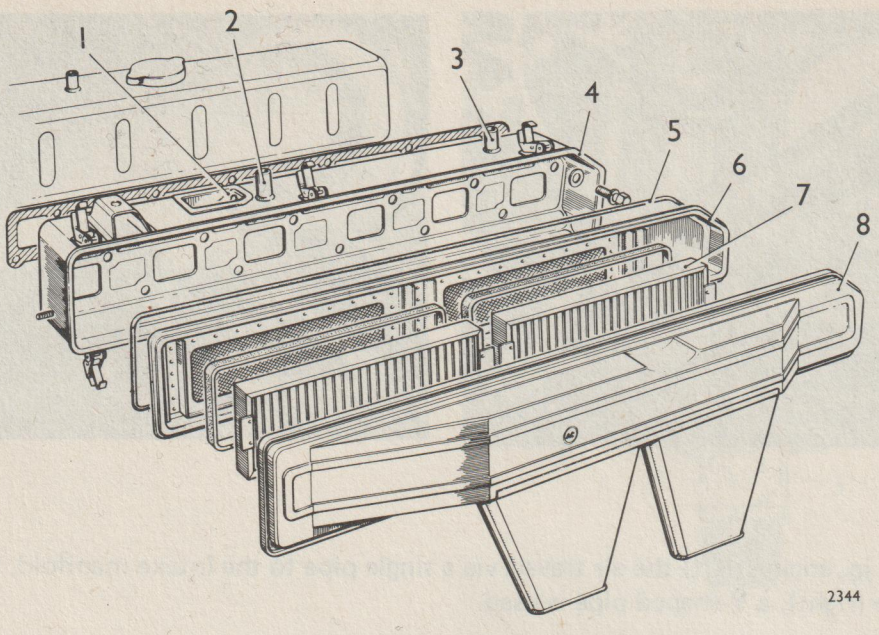
The air cleaner on the 220 cu in. engine is of the oil-bath type which is mounted on the intake manifold. On the 330 cu in. engine, a larger oil-bath cleaner is used, which is mounted on the intake manifold on most vehicles except some coaches when its mounting position is decided by the coachbuilder.

Access to filter element for servicing is gained by removing cover. Filter element should be cleaned in paraffin and dried with compressed air.



Refill oil bath with SAE 50 engine oil, to the level indicated. Before installing cover, check that gasket is serviceable and correctly assembled to cover.

The air cleaner used on the 466 cu in. engine is a paper-element type which is combined with the intake manifold.



The air cleaner and intake manifold consists of a cover (8), filter plate (6) and manifold (4). The cover and filter plate are attached to the manifold by six clips, and a gasket (5) is used between the filter plate and the manifold.

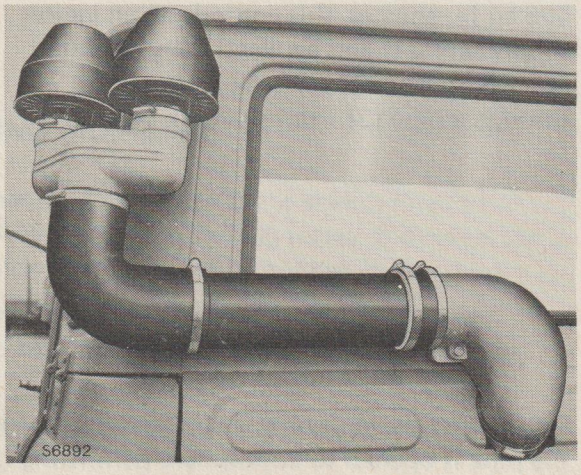
The paper filter elements (7) are supported in the plate by lugs on their casings and are sealed around the perimeter by gaskets.

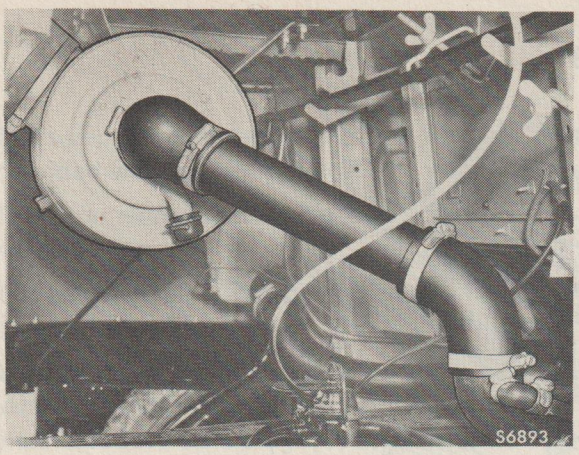
The manifold incorporates connections for the engine ventilation pipe (2) compressor intake air line (3), and an aperture (1) for the cold-start igniter.

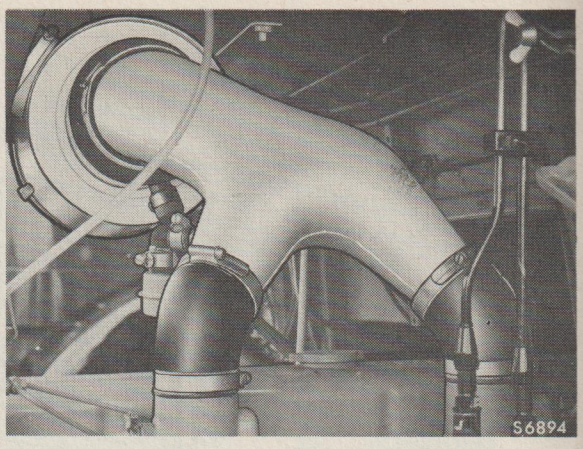
The manifold securing bolts protrude into the cylinder head push rod chambers. On re-assembly, apply Hylomar SQ 32/M jointing compound to bolt threads to prevent oil vapour being sucked into air cleaner and contaminating elements.

85 HEAVY-DUTY AIR FILTRATION

On Series E and HRX trucks with heavy-duty air filtration, twin centrifugal pre-cleaners are mounted externally on the rear of the cab. From these the air passes via a pipe to a paper element type cleaner mounted beneath the rear shelf.







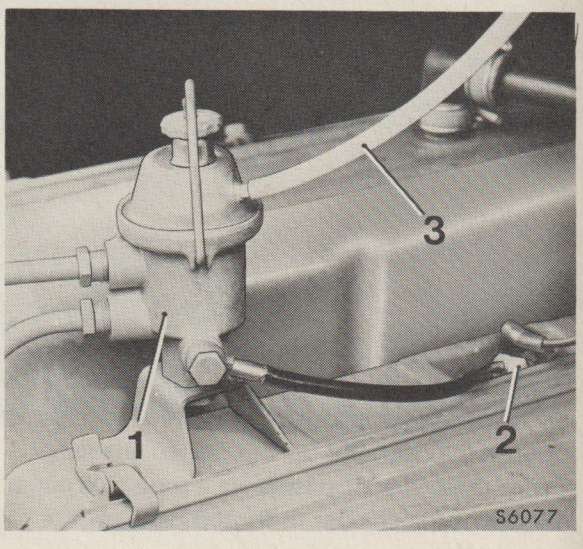
On a 330 cu in. engine (left) the air travels via a single pipe to the intake manifold. On a 466 cu in. engine (right), a Y-shaped pipe is used.

To clean centrifugal units, remove and blow out with compressed air.

Access to cleaner element for servicing is gained by releasing toggle clips securing cover and removing retaining nut and retaining plate.

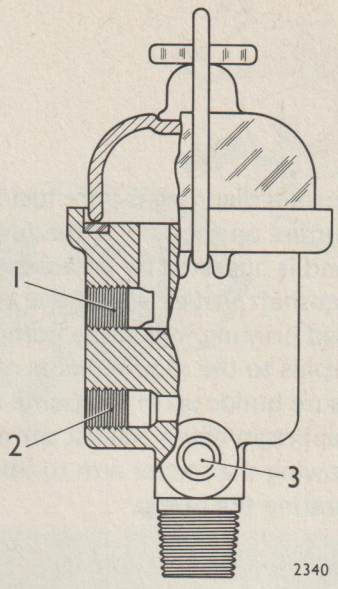
86 COLD-STARTING AID

A cold-starting aid is installed on 330 and 466 cu in. engines, this comprising an igniter supply tank (1) and an electrically-operated igniter (2). The supply tank is vented through a pipe (3) from the tank bowl.

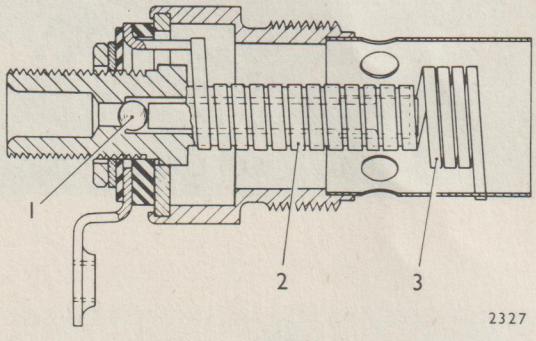


On coaches the vent pipe is connected to the igniter switch. Upon depressing the switch knob, the pipe is opened to atmosphere permitting fuel to flow from the tank bowl to the igniter.

The tank incorporates a supply (2) from the main fuel filter and a delivery (3) to the igniter. Excess fuel is returned to the fuel tank from the upper port (1).



The igniter is screwed into the intake manifold and, in addition to the igniter coils (3), it contains a fuel ball valve (1) which is operated by a heater coil (2).



466 cu in. engines with a separate manifold and air cleaner are equipped with two igniters.

86a COLD-STARTING AID—Igniter Test

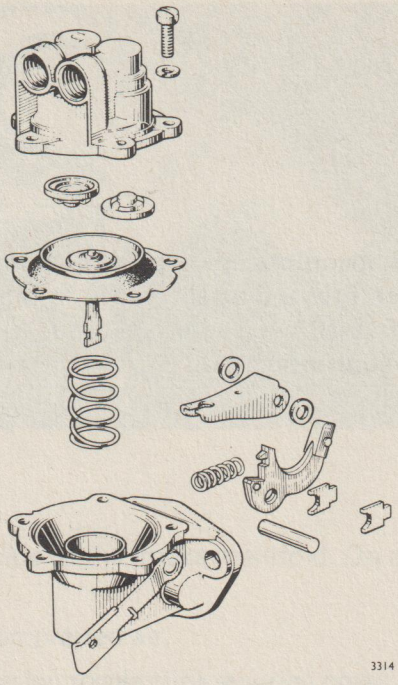
To check igniter for leakage, remove unit from manifold and clean flame shield. Reconnect fuel pipe to igniter and run engine at a fast idle. Any sign of moistening inside or outside flame shield indicates a faulty ball valve and igniter, which being a sealed unit, must be renewed.

If igniter is suspected of leaking only when the intake manifold is under heavy depression, fuel pipe should be disconnected from igniter and blanked off, and vehicle given a road test. If exhaust smoke is reduced igniter is faulty.

Igniter must be removed from vehicle before carrying out any electrical tests as a fire hazard exists when fuel contacts glowing igniter element.

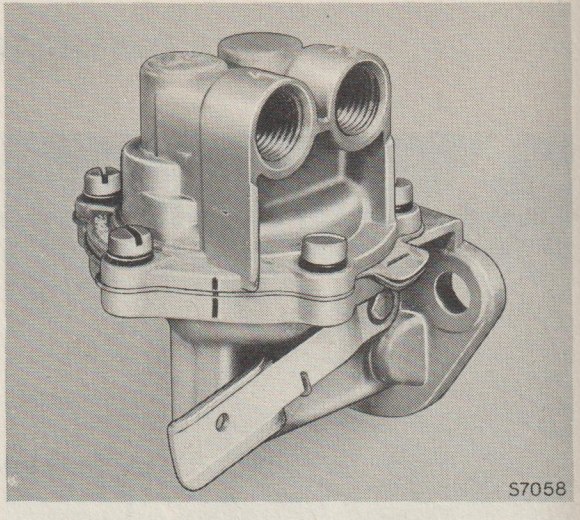
87 FUEL FEED PUMP—220 cu in. Engine

The spring-loaded diaphragm-type fuel feed pump is mounted on the side of the fuel injection pump and is operated by an eccentric on the pump camshaft. An external lever is provided for hand priming. When the pump supplies fuel surplus to the requirements of the engine, pressure builds up in the pump and holds the diaphragm down against spring pressure, allowing the rocker arm to idle without operating the pump.



87a FUEL FEED PUMP—Disassembly and Reconditioning

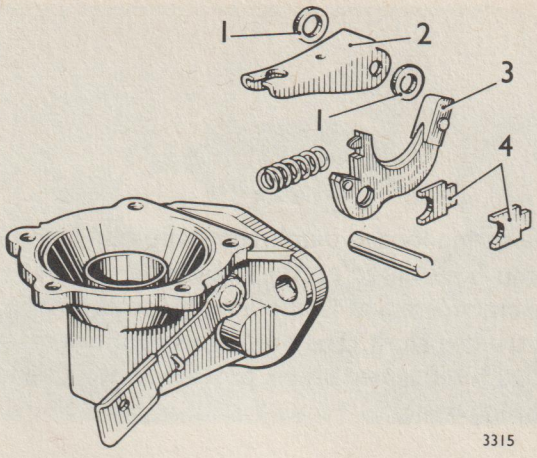
Before parting pump cover from body, mark flanges to ensure correct relationship when reassembling.



If valves are to be renewed, carefully prise valves out of pump cover. Do not remove rocker arm unless parts need renewal.

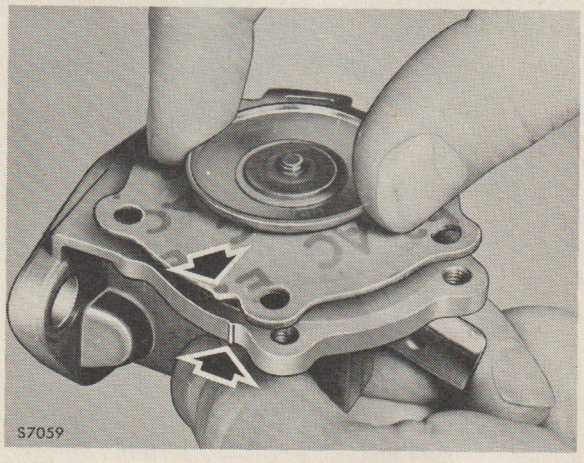
To renew rocker arm or associated parts grip rocker arm firmly in a vice and lever pump body from rocker arm pin, using two flat bars with protective packing against body flange. This will shear staked metal at each end of pin retainers.

When installing rocker arm (3), ensure that link (2) has a spacing washer (1) each side. Secure rocker arm pin retainers (4) in position by staking the body metal on both sides.



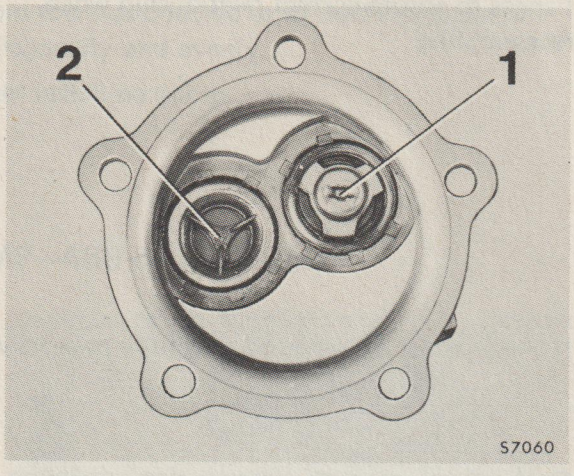
3315

Install diaphragm by depressing and rotating it 90° to engage link and align tab with lug on body.


S7059

Outlet valve (2) must be installed with spring to top of pump, and inlet valve (1) with spring to bottom of pump.

Valves should be tapped or pressed into position, using a sleeve of bore diameter 0.56 in., and external diameter 0.68 in. To secure valves, stake body in five positions around each valve.



S7060

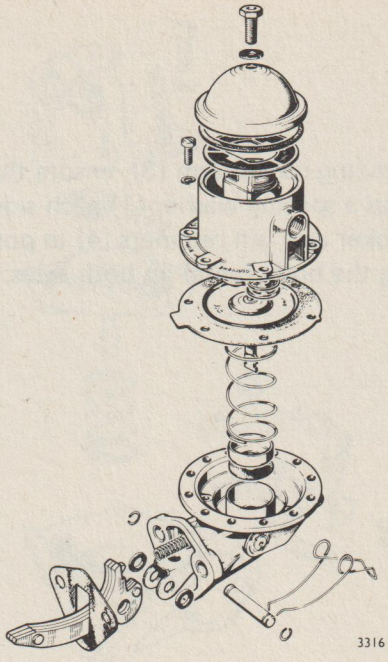
Position cover with marks on flanges in line, and tighten screws finger tight at this stage.

After operating rocker arm several times, hold arm towards body so as to hold diaphragm at the bottom of its stroke, and tighten screws diagonally and evenly.

Fuel system must be vented up to main filter after installing pump.

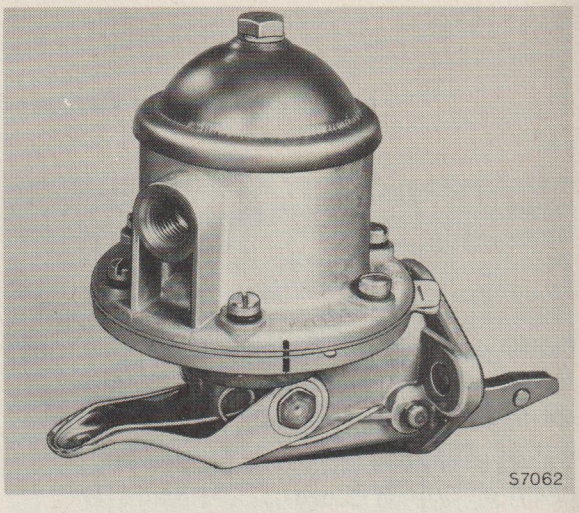
88 FUEL FEED PUMP—330 cu in. Engine

The spring-loaded diaphragm-type fuel feed pump is mounted on the right-hand side of the crankcase and is operated by an eccentric on the camshaft. The pump incorporates a gauze filter screen and is provided with a hand priming lever.



88a FUEL FEED PUMP—Disassembly and Reconditioning

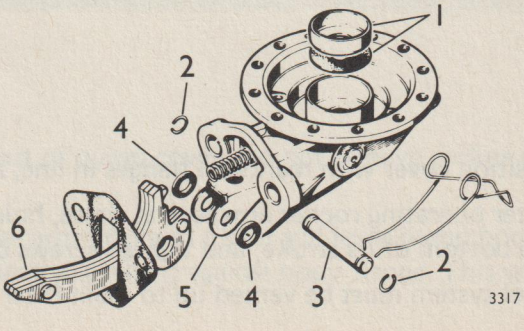
Before parting pump cover from body, mark flanges to ensure correct relationship when reassembling.



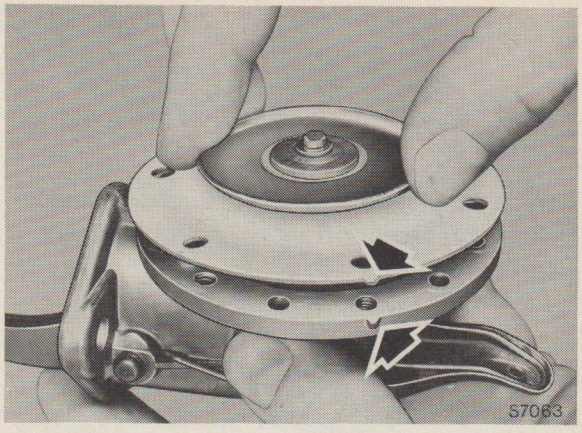
If valves are to be renewed, carefully prise valves out of pump cover.

Rocker arm can be withdrawn after removing one of the circlips (2) and driving out pin (3). Diaphragm rod oil seal and retainer (1) can be prised out after removing staking around retainer.

When installing rocker arm (6) and link (5), locate spacers (4) each side of link.

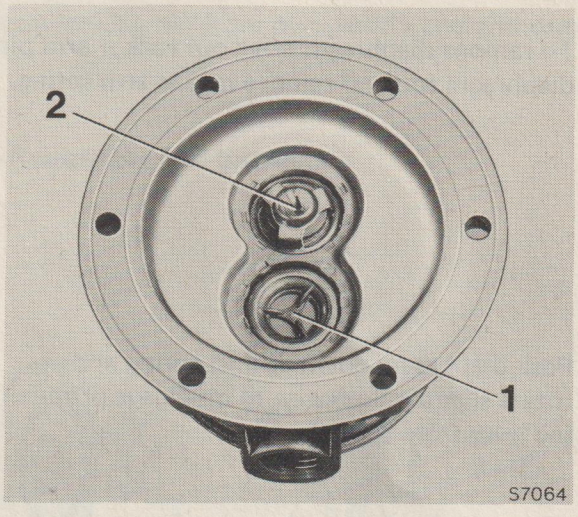


Install diaphragm by depressing and rotating it 90° to engage link and align tab with lug on body.



Outlet valve (2) must be installed with spring to top of pump, and inlet valve (1) with spring to bottom of pump.

Valves should be tapped or pressed into position, using a sleeve with a bore diameter of 0.56 in., and external diameter 0.68 in. To secure valves, stake body in six positions around each valve.



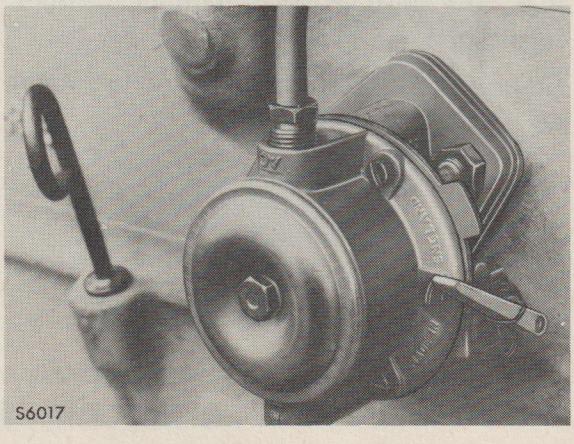
Position cover with marks on flanges in line, and tighten screws finger tight at this stage.

After operating rocker arm several times, hold arm towards body so as to hold diaphragm at the bottom of its stroke, and tighten screws diagonally and evenly.

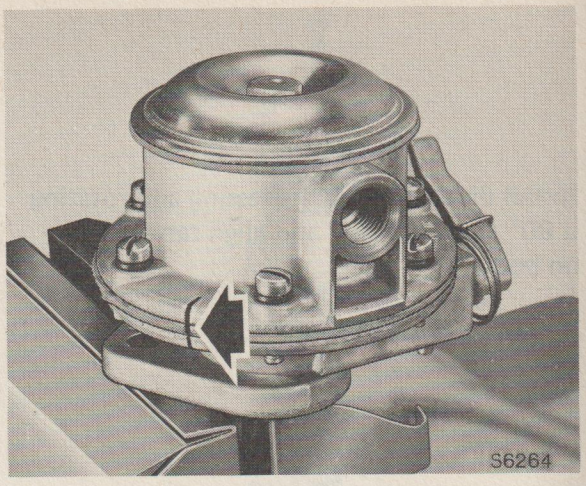
Fuel system must be vented up to main filter after installing pump.

89 FUEL FEED PUMP—466 cu in. Engine

The fuel feed pump incorporates a diaphragm operated by a rod and link coupled to a rocker arm in contact with an eccentric on the camshaft. The pump also has a pulsator diaphragm to smooth out delivery fluctuations. When the pump supplies fuel surplus to the requirements of the engine, pressure builds up in the pump and holds the pumping diaphragm down against spring pressure, allowing the rocker arm to idle without operating the pump.

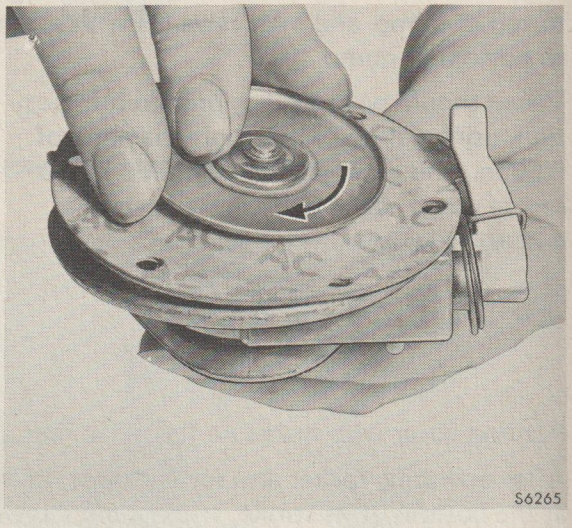


Before parting pump cover from body, mark flanges to ensure correct relationship when reassembling.



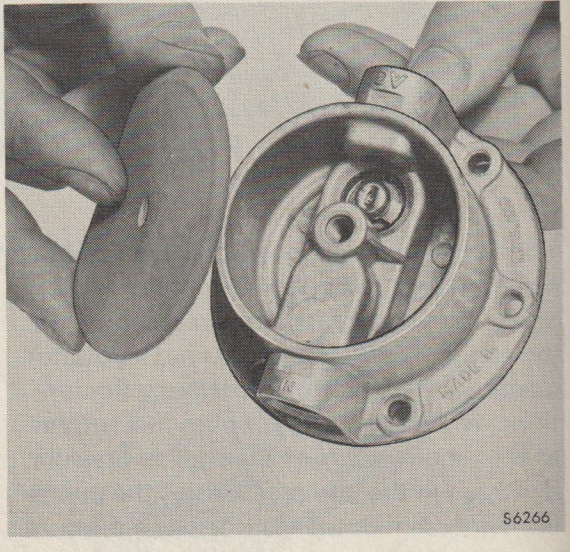
To remove diaphragm drive out rocker arm pin and withdraw rocker arm. Unhook link from diaphragm rod and remove rocker arm spring.

Push diaphragm down against spring and rotate slightly clockwise to disengage priming lever from spring retainer.



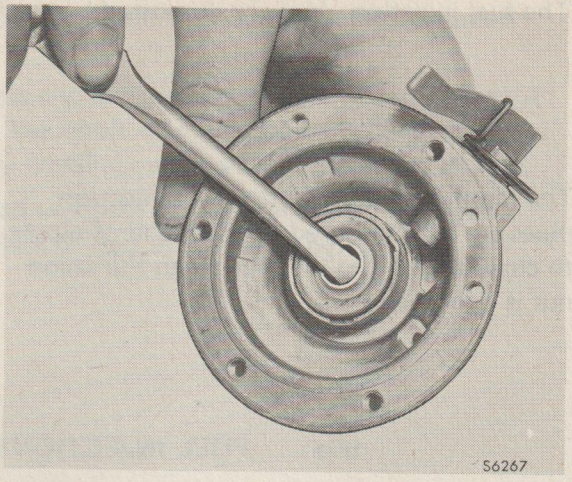
Pulsator diaphragm can be withdrawn after removing pump cover plate.

Ensure pulsator diaphragm centre hole is not enlarged.



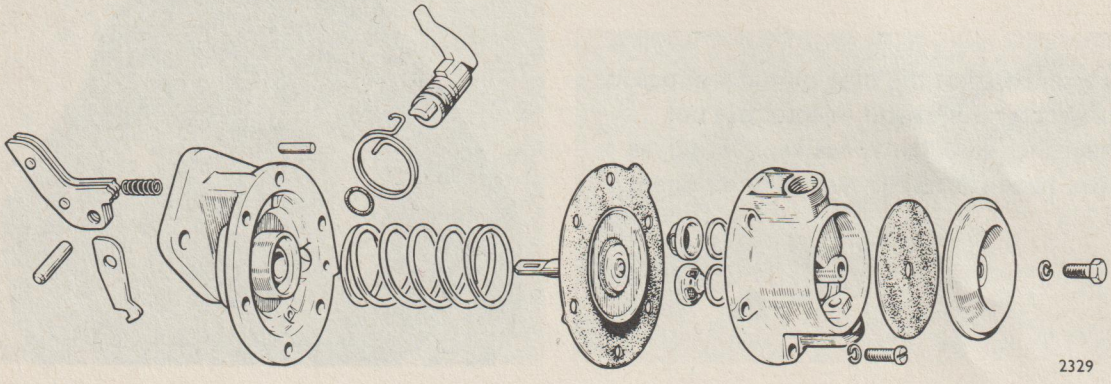
If valves are to be renewed, carefully prise them out of pump cover.

Diaphragm oil seal can be prised out after removing staking.



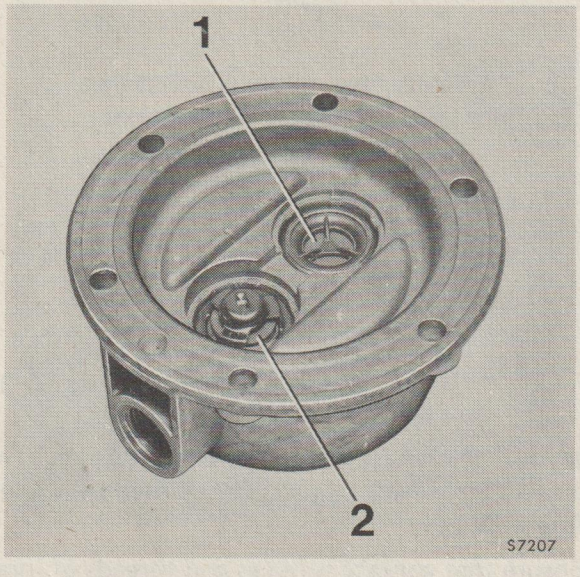
If priming lever or spring are to be renewed, remove locking pin from pump body and withdraw lever and spring.

89b FUEL FEED PUMP—Reassembly and Installation



When installing diaphragm, hook link on to diaphragm rod before installing rocker arm and spring. Re-stake lugs after installation of pin.

Press or tap in new valves using a sleeve with a bore diameter of 0.56 in. and external diameter of 0.68 in. Outlet valve (1) must be installed with spring towards pulsator diaphragm, and inlet valve (2) with spring towards pumping diaphragm. Secure valves by staking in six positions around each valve.



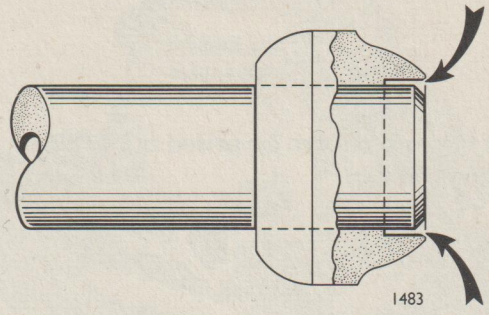
When installing pump cover on body, align marks previously made on flanges.

Fuel system must be vented up to main filter after installing pump.

90 FUEL INJECTION PIPES

The fuel injection pipes are supported by clamping clips which contain rubber dampers.

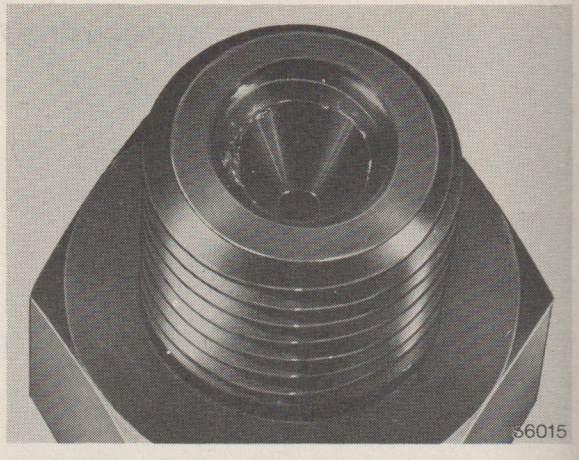
The nipples on replacement fuel injection pipes are counterbored to allow end of nipple to close in and grip the pipe when the union nut is tightened.



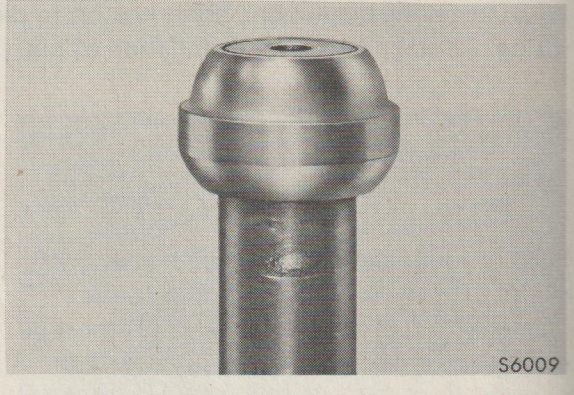
90a FUEL INJECTION PIPES—Removal and Inspection

Before removing injection pipes, clean pipe unions to prevent dirt entering fuel system. After removal seal both ends of pipe, and injector and injection pump orifices.

It is essential that the pipe nipple seatings in the injection pump and injector are not damaged. Even a lightly scarred seating, as shown, necessitates renewal of component.



A pipe which is even mildly grooved by a union nut, as shown, must be renewed.



90b FUEL INJECTION PIPES—Installation

Before installing a new or used injection pipe, wash pipe in paraffin and dry with compressed air. Finally, flush bore of pipe with Shell Calibration Fluid C or equivalent from a filtered supply.

Ensure that contact surfaces and threads of injection pump and injector are clean and position pipe so that each end enters its seating along centre line of pump or injector union orifice. Tighten union nuts finger tight and check that pipe is centrally disposed

where it emerges from nuts. Pipe should remain in a true line with pump or injector union orifice.

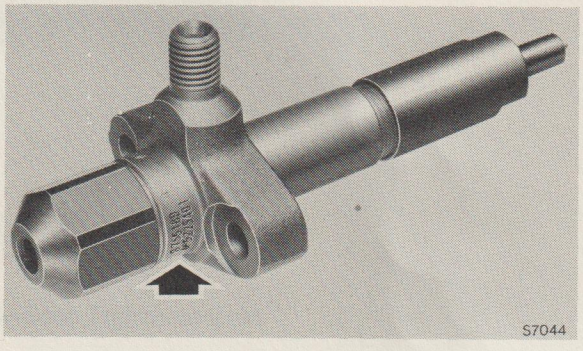
Check that pipe will not be under strain when pipe clip is tightened. If adjustment of pipe is necessary, remove pipe and reform by hand over the whole length as local bending will cause failure. Flush bore of pipe before installing as any bending may have loosened scale in pipe.

Tighten union nuts finger tight plus a further third of a turn with a wrench. Do not over-tighten nuts as this may distort delivery valve holder or lead to failure of pipe.

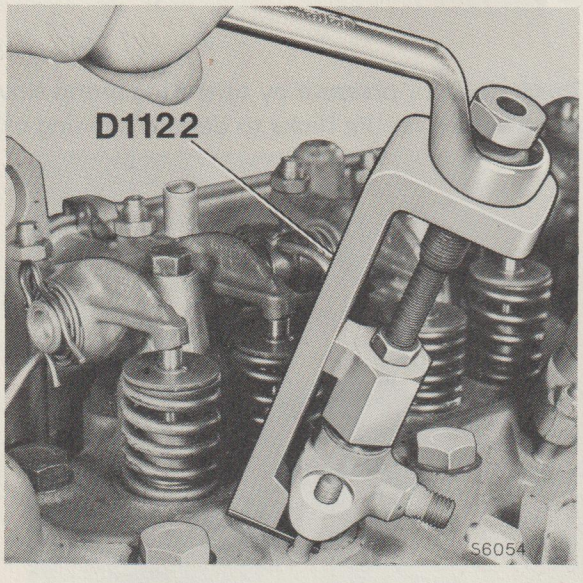
91 INJECTORS

The injectors are of the multi-hole type and are located in sleeves pressed into the cylinder head.

The injectors are identified by the despatch number stamped on the nozzle holder casting.



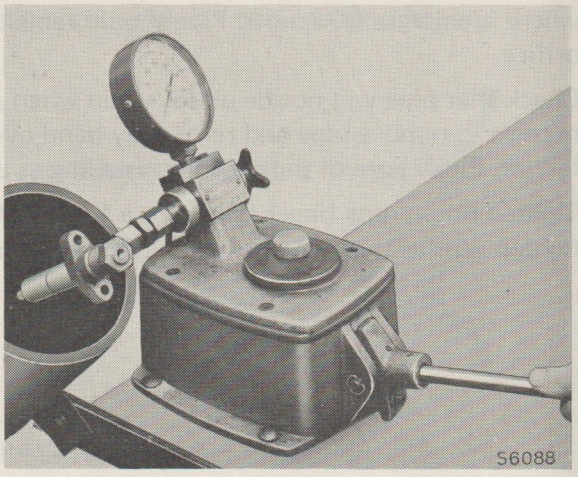
Use Remover D1122 if injector is tight in head.



Before testing, clean injector externally with a wire brush and wash in paraffin. Prevent dirt entering pipe unions.

91 INJECTORS (contd)

After connecting injector to tester operate pump several times to expel air from system before carrying out tests.



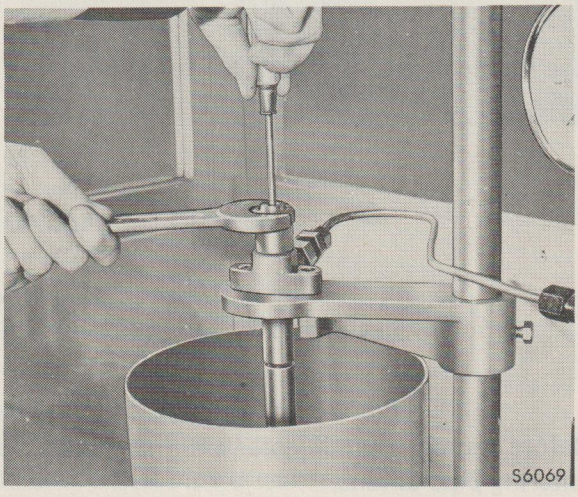
It is essential during the tests that the operator's hands do not contact the spray as this has a strong penetrating force, and can easily puncture the skin.

If the result of any of the tests is unsatisfactory, injector must be disassembled and cleaned, or exchanged.

91a INJECTORS—Pressure Setting

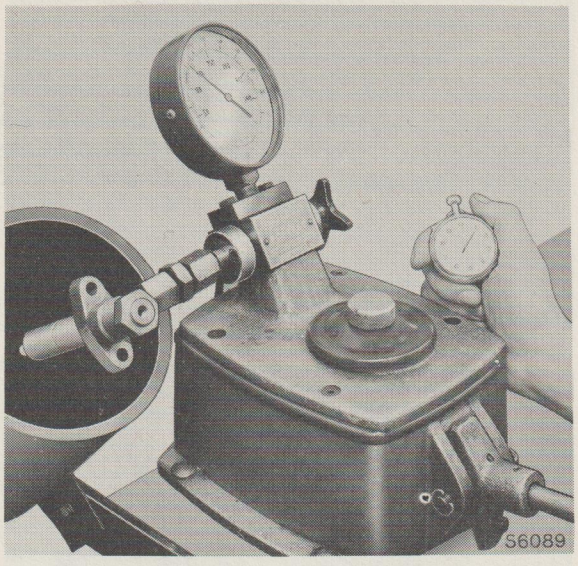
Check delivery pressure by operating pump slowly and noting highest pressure indicated on gauge before needle flicks to denote opening of valve.

Adjust to specified pressure by slackening injector cap and turning spring cap which is accessible through leak-off hole.



91b INJECTORS—Back Leakage Test

To check back leakage build up pressure to approximately 160 atmospheres, allow pressure to fall naturally, and time drop of gauge needle from 150 to 125 atmospheres.

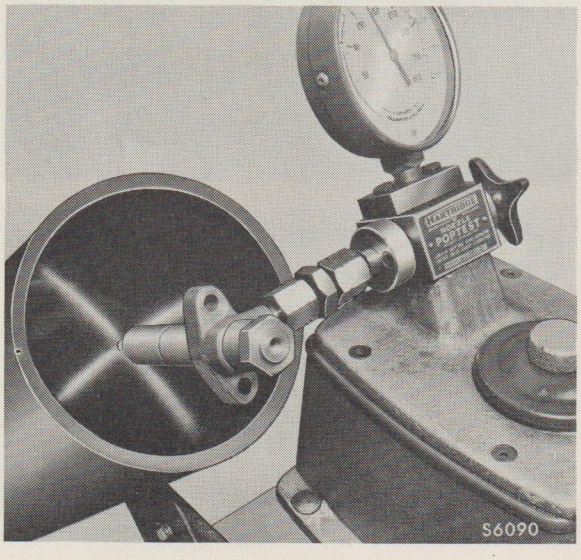


Time must not be less than ten seconds, when using Shell Calibration Fluid C or equivalent, at 10—20°C. If time is low and cannot be improved by further tightening of nozzle cap nut, disassemble and clean, or exchange injector. Do not overtighten nozzle cap nut.

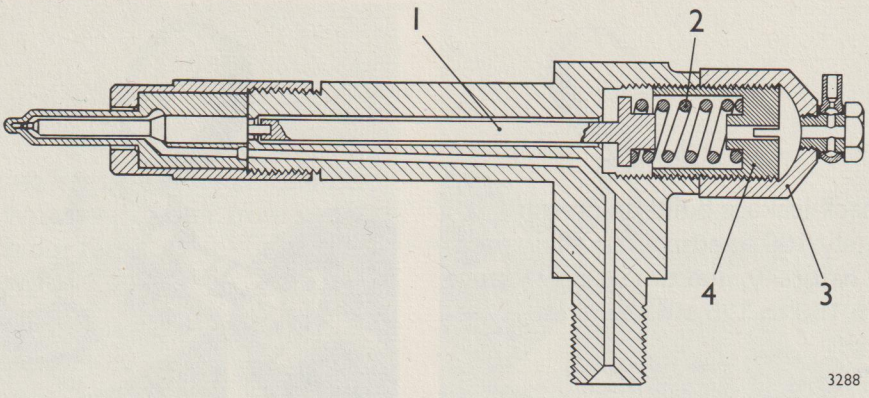
91c INJECTORS—Seat Tightness Test

To check seat tightness wipe nozzle tip dry and hold pressure steady at 165 atmospheres. Nozzle tip must remain substantially dry, with no tendency for fuel to collect or drip. Slight dampness may be ignored.

Check spray form by operating pump at approximately 90 strokes per minute. Sprays should be completely atomised with equal penetration into surrounding atmosphere, and free from coarse or solid streaks.

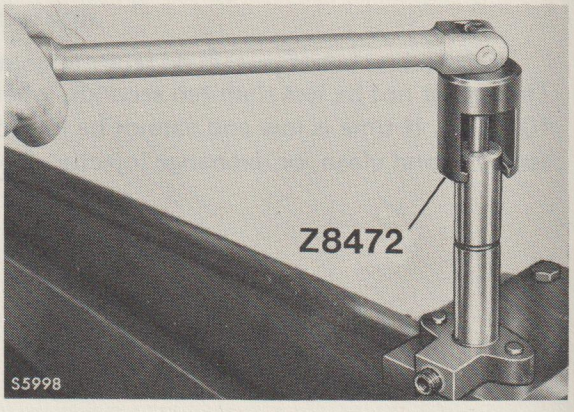


91d INJECTORS—Disassembly



Nozzle spring (2) and valve spindle (1) may be withdrawn after removing nozzle holder cap (3) and spring cap (4).

Remove nozzle and valve after unscrewing nozzle cap nut with Wrench Z8472.



When more than one injector is disassembled, keep valves with their respective nozzles as they are matched pairs.

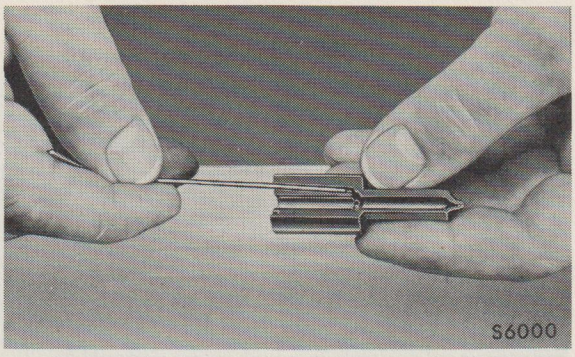
91e INJECTORS—Inspection and Cleaning

Clean all parts in Shell Calibration Fluid C or equivalent and place clean parts in a second tray of clean fluid.

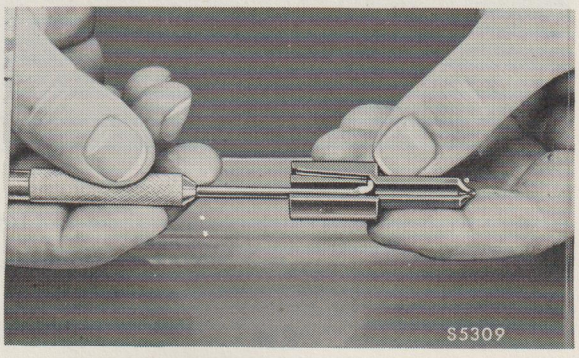
Valve should be cleaned by scrubbing with a brass wire brush.

Scrub nozzle with a brass wire brush. If joint face is damaged, or nozzle tip shows signs of blueing due to overheating, renew nozzle and valve.

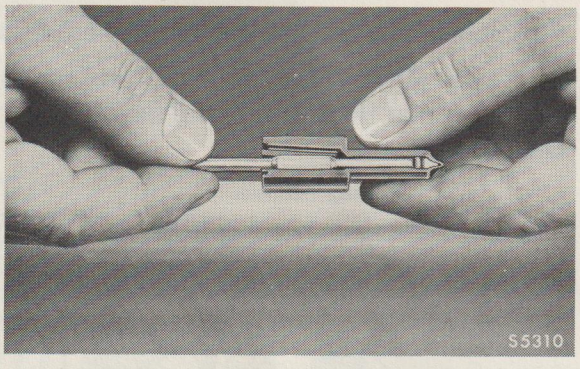
Feed channel bore may be cleaned with wire.



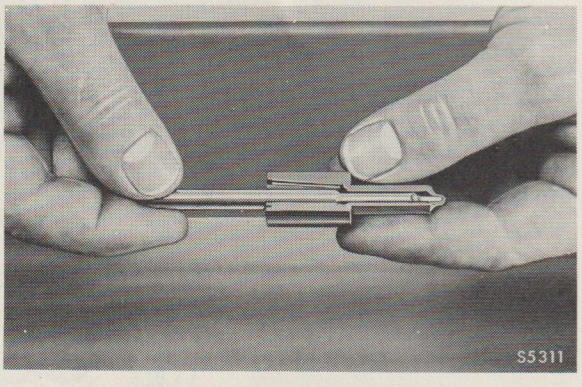
Nozzle groove may be cleaned with a scraper. Care should be taken to prevent damage to valve spindle aperture.



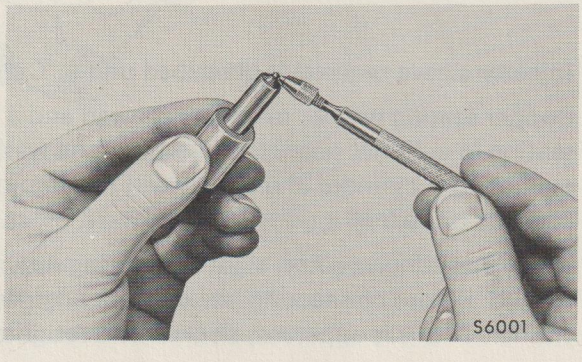
Carbon may be removed from valve seat with a nozzle seat scraper.



Cavity in nozzle tip below valve seat may be cleaned with a dome cavity scraper.

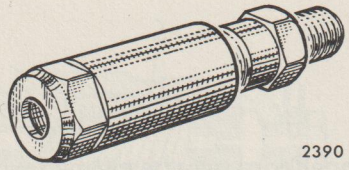


Spray holes may be cleaned with a probing tool fitted with the appropriate wire (see 'Specifications').

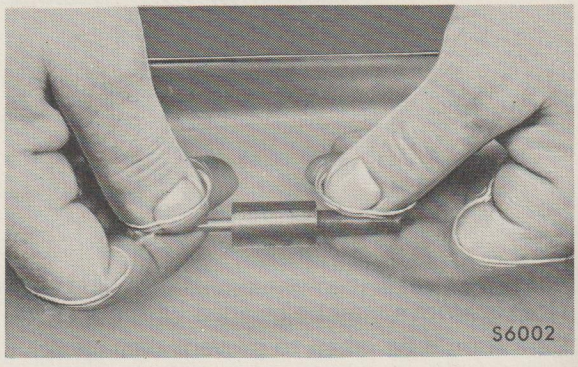


91e INJECTORS – Inspection and Cleaning (contd)

Before installing valve in nozzle, assemble nozzle to Adaptor 7044–137 and back flush on injector tester.



Assemble valve to nozzle and work the two together in a clean tray of fluid. Check that valve will slide from nozzle under its own weight.



Ensure that pressure surfaces of nozzle and holder are clean and undamaged as these must register together to form a high pressure joint.

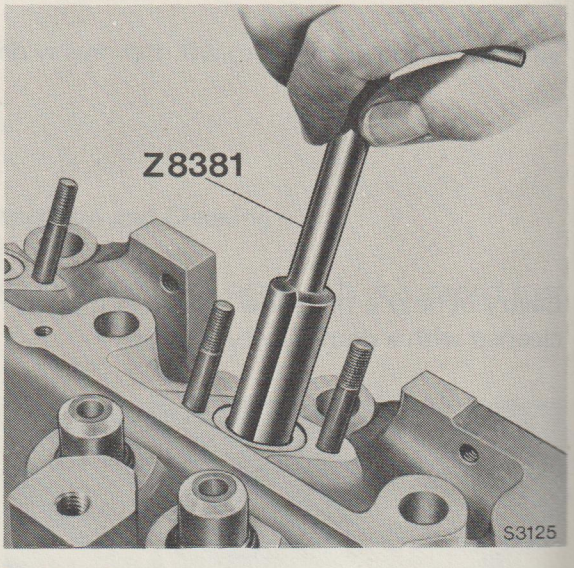
91f INJECTORS–Reassembly and Installation

Assemble nozzle and valve to holder before assembling any other parts.

Before carrying out injector tests, leave spring free of tension, assemble injector to the tester and check that fluid issues from spray holes in four straight jets which will not all be at the same angle.

91g INJECTORS–Installation

Before installing injector, clean sleeve and seat face in cylinder head with Cleaner Z8381. Grease tool to prevent carbon and dirt entering engine.



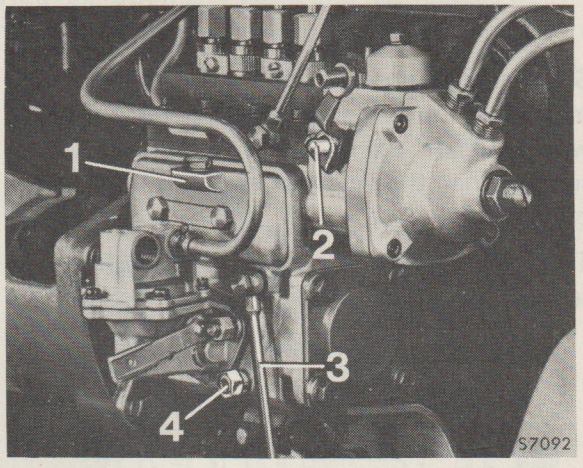
Injector sleeve renewal is described under 'Cylinder Head'.

Copper seating washer must be renewed and a check made for additional washers adhering to seating in cylinder head. If more than one washer is used, injector nozzle with not project far enough into cylinder and sprays will not impinge correctly on piston causing excessive smoke and loss of power.

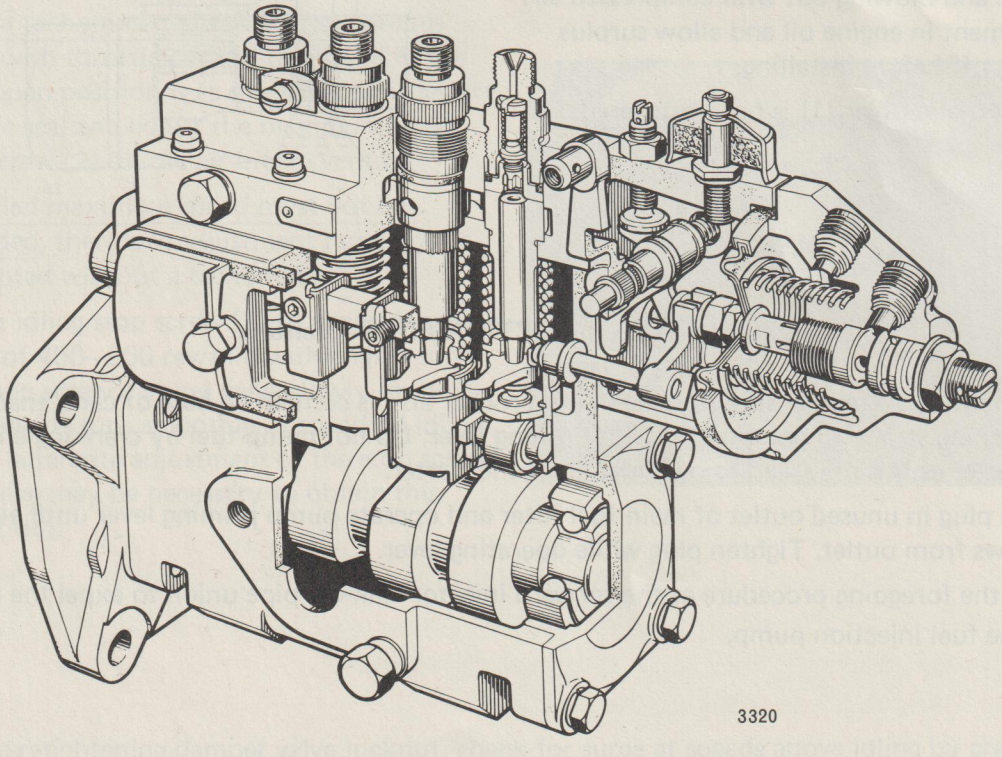
When installing injector, tighten securing nuts finger tight, then tighten evenly to specified torque. Before connecting pipes, crank engine with starter and check for blow past seating washer. If this is apparent, slacken and retighten injector securing nuts.

92 FUEL INJECTION PUMP—220 cu in. Engine

The Simms fuel injection pump used on the 220 cu in. engine is a pneumatically-governed in-line type, flange mounted on a carrier attached to the air exhauster or compressor. A rear support bracket is bolted to the underside of the pump and the crankcase. The pump is lubricated by oil contained in the cambox which is provided with a drain plug (4) and an oil level drain pipe (3). The oil filler plug (1) is situated in the pump side cover.

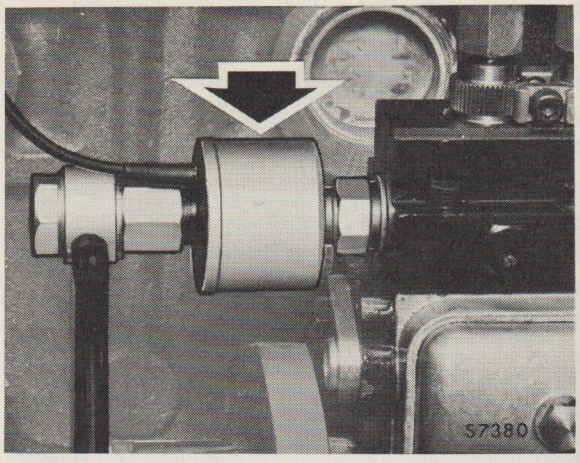


An excess fuel device incorporated in the governor is operated by a plunger (2), on the stop control lever shaft. To operate, push plunger to face of stop control lever and fully depress and release accelerator pedal. Plunger automatically releases after engine has started.



The coupling comprises two dogged flanges insulated from each other by a rubber insert.

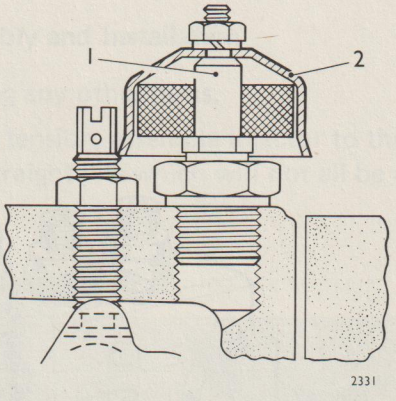
The front flange is secured to the compressor or exhauster shaft by a clamping plate which is keyed and clamped by a bolt and nut to the shaft, and attached to the coupling flange by bolts. The clamping plate bolt holes are elongated to facilitate pump timing.



Some engines are equipped with an automatic fuel shut-off solenoid valve (arrowed) which cuts off the injection pump fuel supply when the key start switch is in the off position.

The solenoid valve is a sealed unit and is serviced by renewal.

92a FUEL INJECTION PUMP—Air Breather



Breather filter element can be withdrawn after removing cap (2), which is secured by a nut. Element should be cleaned by rinsing in clean paraffin and blowing out with compressed air. Dip element in engine oil and allow surplus to drain off before installing.

Ensure hole in pillar (1) is not obstructed.

92b FUEL INJECTION PUMP—Venting

Before venting system, ensure fuel feed pump rocker arm is contacting base of cam, enabling full pumping stroke to be obtained with priming lever. Do not pump fuel by cranking engine with starter as this may lead to overheating of the starter.

Slacken plug in unused outlet of main fuel filter and operate pump priming lever until air-free fuel flows from outlet. Tighten plug while operating lever.

Repeat the foregoing procedure at the forward injector leak-off pipe union to expel the air from the fuel injection pump.

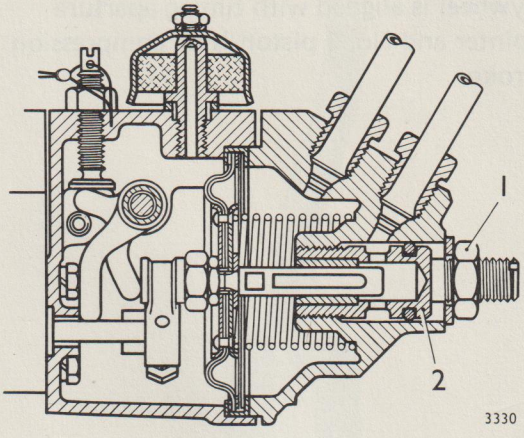
92c FUEL INJECTION PUMP—Governor Adjustment

The engine must not be rotated or started with the governor pipes disconnected or with the damper valve removed, as there is no control over the engine speed.

Should the engine be started inadvertently, operate the stop control until the engine ceases to run.

The following adjustments should only be carried out after ensuring that the engine is otherwise functioning correctly. Check that the throttle operation is smooth and the linkage free from excessive play. Check the cleanliness of the air cleaner and ensure that it is correctly connected to the venturi.

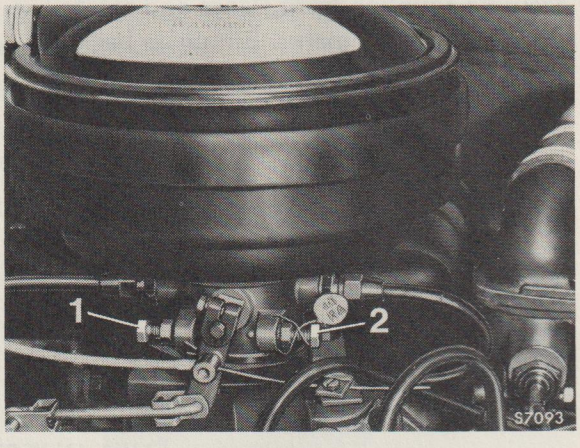
With engine at normal operating temperature slacken damper valve locknut (1) and unscrew valve guide (2) until its larger diameter is approximately flush with rear face of housing.



Using a tachometer, check that maximum speed with throttle control lever held in the fully open position is as specified. If necessary, remove seal and adjust the maximum speed stop screw (2) on the air intake venturi.

Specified maximum speed must not be exceeded, therefore adjustment must not be attempted without a tachometer.

Adjust idling stop screw (1) to produce engine speed of 450–500 rev/min with engine surging, then screw damper valve slowly inwards until engine runs smoothly at specified idling speed (alternate adjustment of the stop screw and valve may be necessary to obtain this condition).

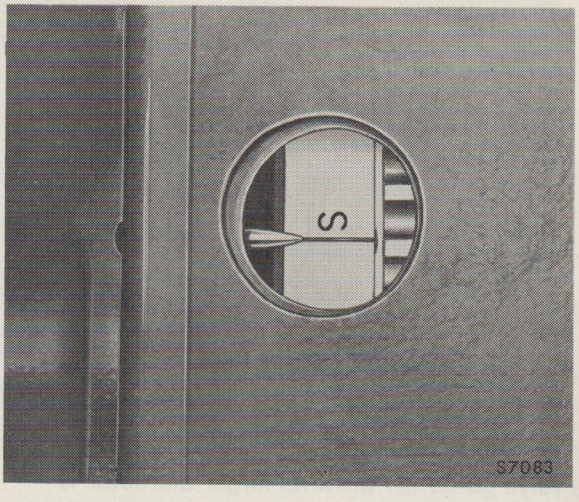


Before retightening damper valve locknut, check for surge at speeds above idling by gradually increasing engine speed up to approximately 1200 rev/min. Should surge occur, adjust idling speed control, or manipulate the throttle, to give the worst surge condition. Readjust damper valve until surge is eliminated (valve will probably have to be screwed outwards slightly), and then recheck the idling.

Complete absence of surging may be difficult to achieve in which case valve should be adjusted to give the best compromise. This adjustment is often critical to a fraction of a turn.

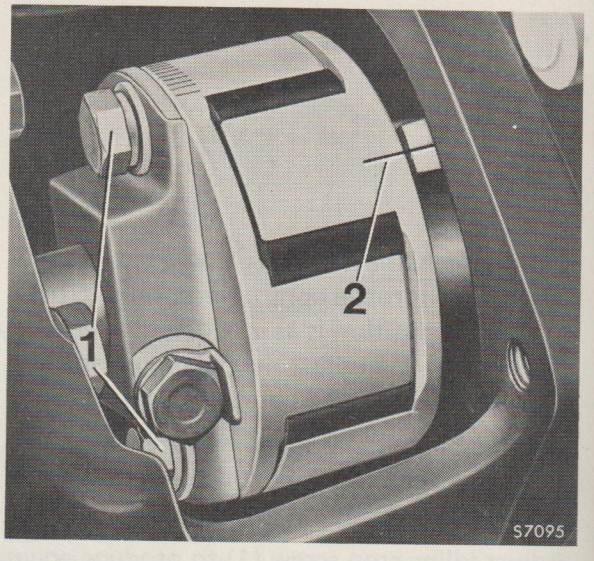
92d FUEL INJECTION PUMP—Timing Check

To check pump timing turn engine in normal direction of rotation until timing mark on flywheel is aligned with timing aperture pointer and No. 1 piston is on compression stroke.



Timing mark (2) on pump coupling should be in line with mark on pump.

If necessary adjust by slackening two bolts (1) securing coupling front flange and rotate coupling to align marks. Eliminate backlash in timing gears while making adjustment.

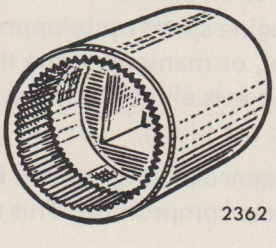


92e FUEL INJECTION PUMP—Spill Timing

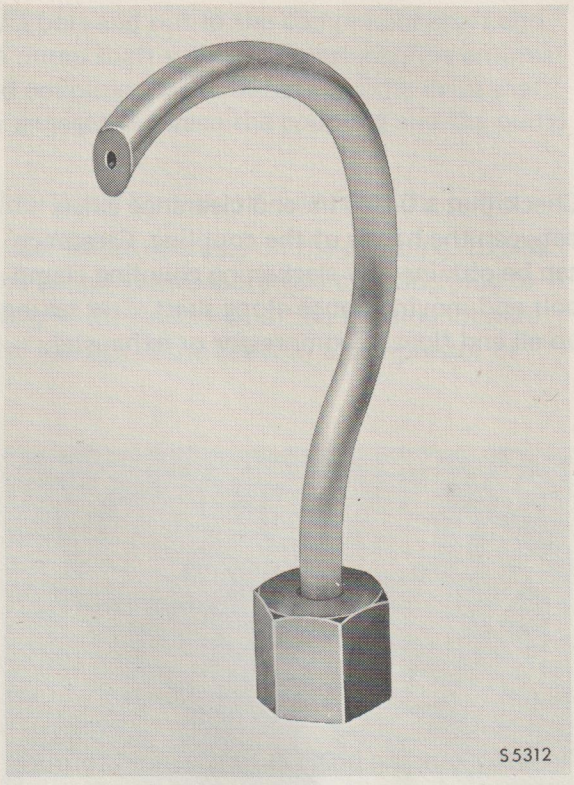
To check accuracy of timing marks on coupling and pump the following check should be made.

Remove delivery valve holder from No. 1 cylinder connection on pump and withdraw delivery valve, spring and peg. Replace holder and attach a test pipe.

Use Wrench TS9 to remove delivery valve holder.



Test pipe can be made from an injector pipe assembly with the open end cut at an acute angle.



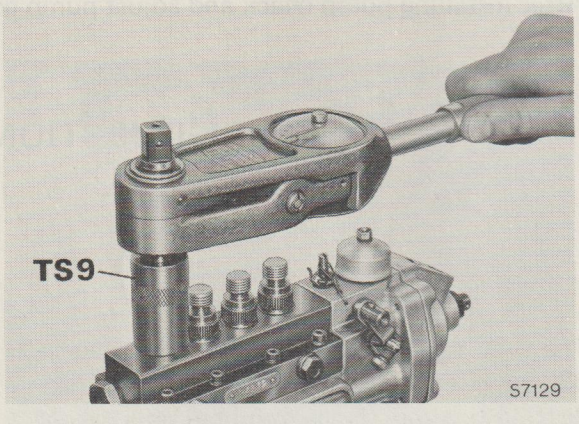
Slacken forward injector leak-off pipe union and operate priming lever on feed pump until air-free fuel flows from union. Tighten union while operating priming lever.

Turn engine in normal direction of rotation until timing mark on flywheel is aligned with timing aperture pointer and No. 1 piston is on compression stroke.

Slacken the two bolts securing coupling front flange and, while holding front flange stationary to eliminate backlash, operate priming lever on feed pump while slowly turning coupling clockwise until fuel almost ceases to be discharged from test pipe.

Mark coupling in line with mark on fuel pump after tightening flange bolts.

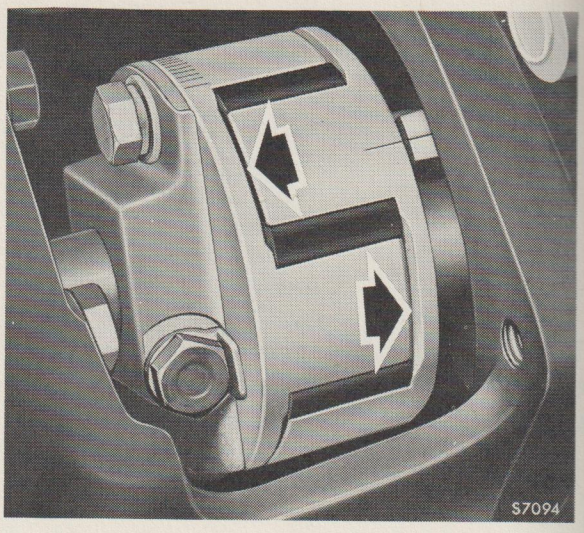
After installing delivery valve, spring and peg, tighten holder to specified torque and check for free movement of pump control rod by operating and releasing stop control lever. A sharp click should be audible as rod returns against maximum fuel stop.



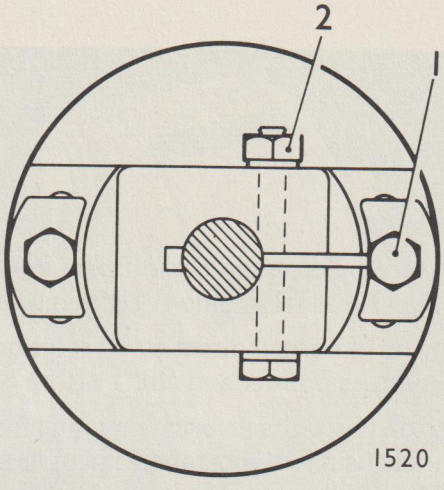
92f FUEL INJECTION PUMP—Removal and Installation

Before removing pump scribe a line across coupling to assist in timing pump on installation. Coupling will part at dogs.

When installing pump tighten bolts securing pump to carrier before tightening support bracket bolts to specified torque.



Check that a 0.020 in. end clearance exists between the halves of the coupling. Clearance can be obtained by slackening coupling clamp bolt and moving flange along shaft after taking up all end float in compressor or exhauster.

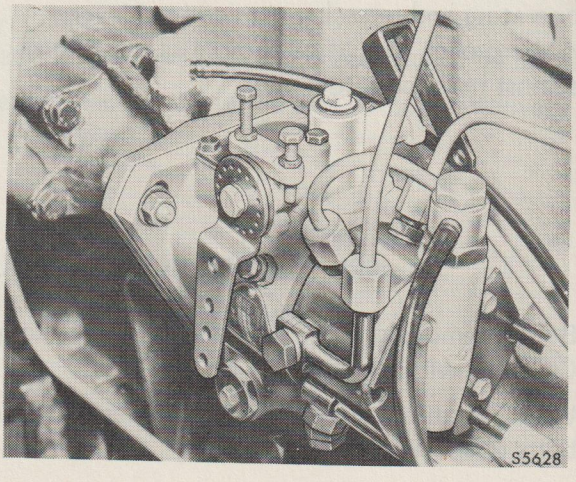


Tighten clamping bolt (2) to specified torque before tightening adjustment bolt (1). If adjustment bolt is tightened first, it will prevent clamping slot closing.

On installation, check that oil level in cambox is correct before starting engine.

After installing pump check and adjust pump governor as detailed in Section 92a.

93 FUEL INJECTION PUMP–330 cu in. Engine



The CAV fuel injection pump used on the 330 cu in. engine is a hydraulically governed distributor type, flange mounted on a carrier attached to the air compressor. The rear end of the carrier is supported by a bracket bolted to the crankcase.

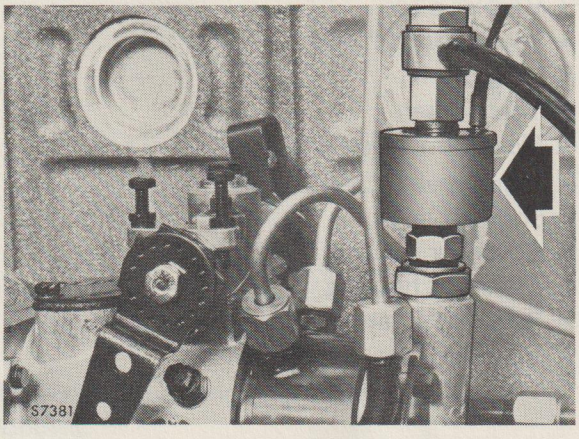
The drive shaft coupling is keyed and clamped by a bolt and nut to the compressor shaft and is splined at the rear end for engagement with the pump shaft splines. A master spline ensures correct timing relationship between the pump and coupling. Backlash between the drive shaft and coupling splines is prevented by a torsion bar engaged between the coupling and the pump rotor assembly.

The carrier encloses the pump coupling which is lubricated by leak-off fuel from the pump.

The fuel is retained in the rear of the carrier by a seal which operates on the coupling. Excess leak-off fuel is returned to the main fuel filter. The coupling incorporates a blanking plug to prevent fuel leakage through the coupling. A drilling in the underside of the housing forward of the coupling seal provides evidence of fuel or oil leakage in the event of a compressor or coupling seal failure.

Some engines are equipped with an automatic fuel shut-off solenoid valve (arrowed) which cuts off the injection pump fuel supply when the key-start switch is in the off position.

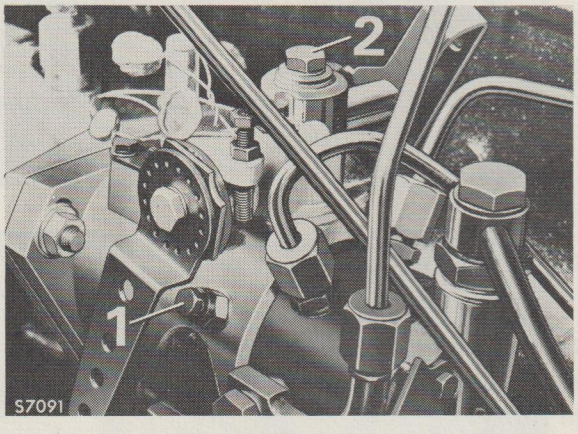
The solenoid valve is a sealed unit and is serviced by renewal.



93a FUEL INJECTION PUMP—Venting

Before venting system, ensure fuel feed pump rocker arm is contacting base of cam, enabling a full pumping stroke to be obtained with priming lever. Do not pump fuel by cranking engine with starter as this may lead to overheating of the starter.

Slacken plug in unused outlet of main fuel filter and vent screw on pump body (1) and governor housing (2). Operate feed pump priming lever until air-free fuel flows from outlet on main filter and tighten plug while operating lever. Continue priming until air-free fuel flows from vent screw on pump body, then tighten screw.



Slacken two injection pipe unions, operate starter and as soon as engine runs, tighten unions and vent screw on governor housing.

When an additional main filter is installed, the one incorporating the sediment trap should be vented first.

93b FUEL INJECTION PUMP—Idling Adjustment

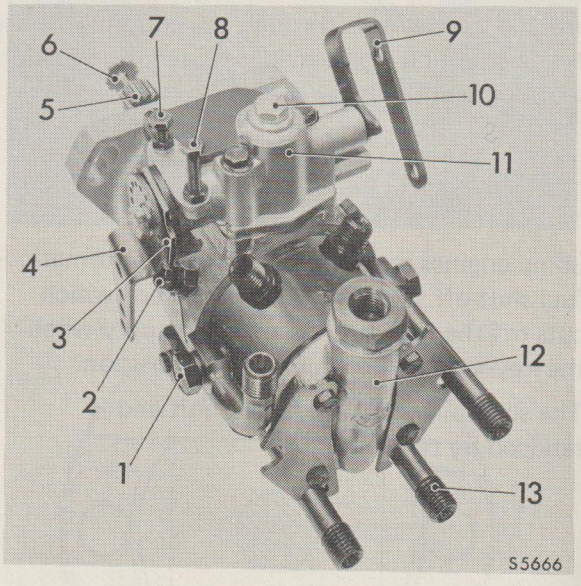
The engine idling speed is controlled by a hexagon-head screw which contacts a bracket attached to the speed control lever on the governor housing.

On vehicles equipped with an idling control ensure that clearance exists between the nipple on the control wire and its connection on the accelerator pedal linkage.

With engine at normal operating temperature, check idling speed with a tachometer and, if necessary, adjust idling stop screw to obtain specified engine idling speed.

Fuel injection pump details

1. Pressurising valve
2. Pump body
3. Vernier plate
4. Speed control lever
5. Drive shaft
6. Torsion bar
7. Maximum speed screw
8. Idling speed screw
9. Shut-off lever
10. Governor housing vent screw
11. Governor housing
12. Regulating valve
13. Injection pipe connections

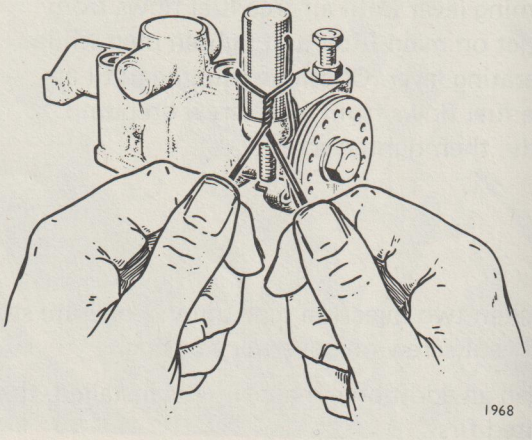


93c FUEL INJECTION PUMP—Maximum Speed Adjustment

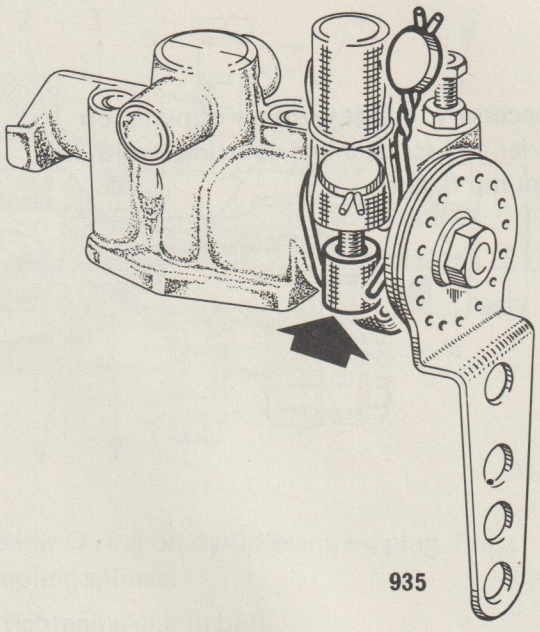
The engine maximum speed is controlled by a hexagon-head screw which contacts a bracket attached to the speed control lever on the governor housing. The screw is sealed against unauthorized interference.

To adjust maximum speed, run engine until normal temperature is attained. Move speed control lever by hand to maximum speed position and check engine speed with a tachometer. If necessary break seal, remove cover and adjust screw to obtain specified maximum speed.

After completing adjustment, install cover and retain with wire as shown. Seal must trap twist in wire.



Specified maximum speed must not be exceeded, therefore adjustment must not be attempted without a tachometer.

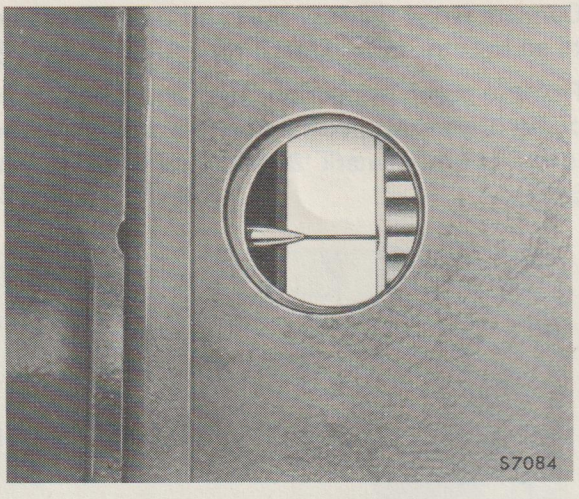

935

After adjusting engine maximum speed on a new or rebuilt engine install extension collar on bottom of stop screw to restrict maximum speed to approximately 2500 rev/min during the first 500 miles running. Secure collar with wire and seal.

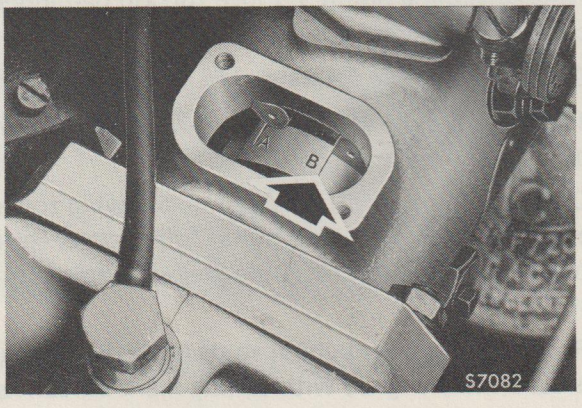
93d FUEL INJECTION PUMP—Timing Check

To check accuracy of the timing marks on the pump and carrier flanges, or after installing a new pump carrier which is unmarked, proceed as follows:

Turn engine in normal direction of rotation until flywheel timing mark is aligned with timing aperture pointer and No. 1 piston is on compression stroke.


S7084

Remove inspection cover from top of pump body and check that timing mark 'B' on pump rotor is aligned with squared end of circlip.



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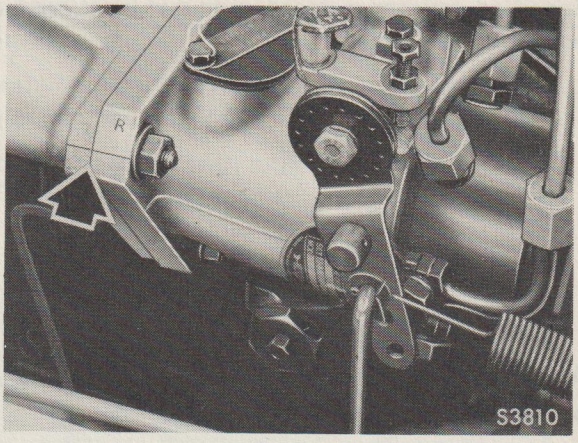
93d FUEL INJECTION PUMP – Timing Check (contd)

If necessary, adjust position of pump on carrier and scribe a line coincident with line on pump flange.



93e FUEL INJECTION PUMP—Timing Circlip Setting

If, after checking the pump to engine timing, the engine still appears to be incorrectly timed, the circlip in the pump may be incorrectly positioned.

To verify circlip setting, injection pump must be removed and thoroughly cleaned externally.

Connect No. 1 delivery port and the port diametrically opposite, by means of a stirrup pipe, to an injector testing machine.

Remove pump inspection cover and pressurize system to not more than 30 atmospheres. Turn pump drive shaft in direction indicated by arrow on pump identification plate until resistance is felt. If timing mark 'B' on pump rotor does not align with squared end of circlip, reposition circlip.

93f FUEL INJECTION PUMP—Installation

When installing pump, remove torsion bar and end plate from pump and insert into pump coupling on compressor shaft.

Check that O-ring is serviceable and correctly installed in recess in pump attaching face.

Turn pump drive shaft so that master spline is in approximate alignment with master spline on drive coupling.

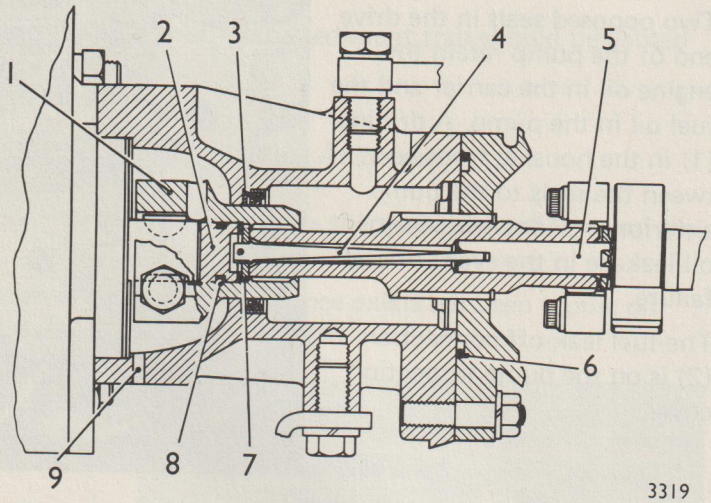
Offer up pump to drive coupling, allowing torsion bar to enter bore of drive shaft. Carefully engage splines then push pump fully home. Resistance will be felt as the torsion is forced to twist when it enters its guide. Secure pump with retaining nuts, but do not tighten at this stage.

Rotate pump on retaining studs until timing mark scribed on edge of pump mounting flange is accurately aligned with timing mark on carrier and tighten retaining nuts.

93g FUEL INJECTION PUMP—Carrier and Coupling

Details of fuel injection pump coupling

1. Coupling
2. Nylon plug
3. Shim
4. Torsion bar
5. Guide dog
6. O-ring
7. End plate
8. O-ring
9. Tell-tale hole



3319

Before installing coupling on compressor shaft, renew O-ring on nylon blanking plug. Press shim and plug into coupling to register against coupling splines.

Install coupling fully on compressor shaft before tightening clamp bolt.

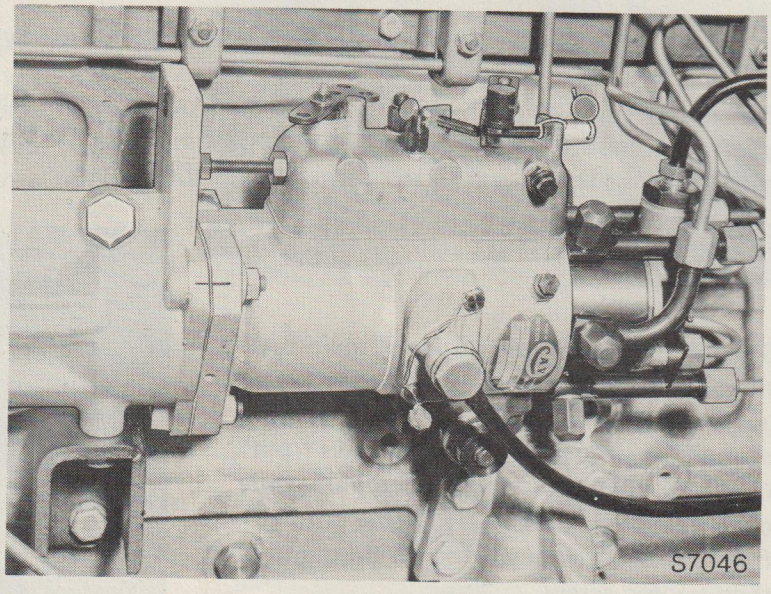
When renewing carrier oil seal, install seal with lip towards fuel injection pump.

To avoid distorting carrier on installation, slacken carrier support bolts before attaching carrier to compressor. Install support to carrier bolt finger tight. Tighten bolts securing support to cylinder block before tightening support to carrier bolt to specified torque.

94 FUEL INJECTION PUMP—466 cu in. Engine

The CAV fuel injection pump used on the 466 cu in. engine is a mechanically-governed distributor-type, flange mounted on a carrier attached to the air compressor. The rear end of the carrier is supported by a bracket bolted to the cylinder block.

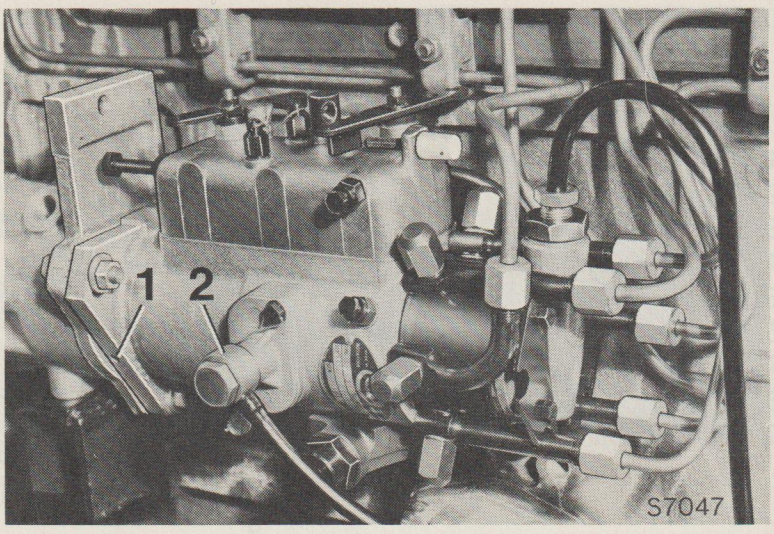
The drive shaft coupling is keyed and clamped by a bolt and nut to the compressor shaft and is splined at the rear end for engagement with the pump shaft splines. A master spline ensures correct timing relationship between the pump and coupling.


S7046

The carrier encloses the pump coupling which is lubricated by engine oil supplied from the rear of the compressor.

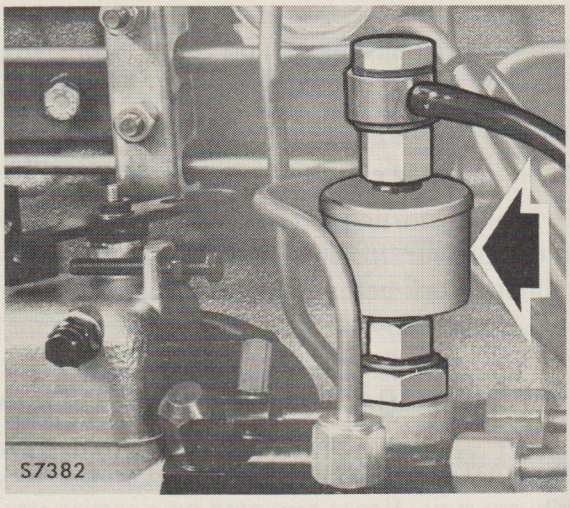
Two opposed seals in the drive end of the pump retain the engine oil in the carrier and the fuel oil in the pump. A drilling (1) in the housing from between the seals to the pump exterior provides evidence of oil leakage in the event of seal failure.

The fuel leak-off connection (2) is on the pump inspection cover.



Some engines are equipped with an automatic fuel shut-off solenoid valve (arrowed) which cuts off the injection pump fuel supply when the key-start switch is in the off position.

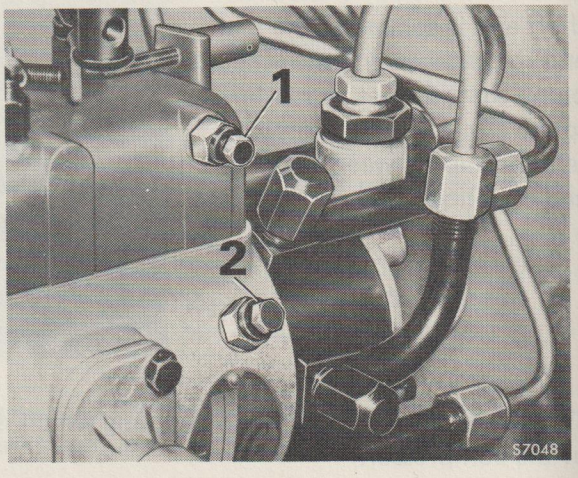
The solenoid valve is a sealed unit and is serviced by renewal.



94a FUEL INJECTION PUMP–Fuel System Venting

Before venting system, ensure fuel feed pump rocker arm is contacting base of cam, enabling a full pumping stroke to be obtained with priming lever. Do not pump fuel by cranking engine with starter as this may lead to overheating of the starter.

Slacken plug in unused outlet of main fuel filter and vent screws on pump body (2) and governor housing (1). Operate feed pump priming lever until air-free fuel flows from outlet on main filter and tighten plug while operating lever. Continue priming until air-free fuel flows from vent screw on pump body, then tighten screw.



Slacken two injection pipe unions, operate starter and as soon as engine runs, tighten unions and vent screw on governor housing.

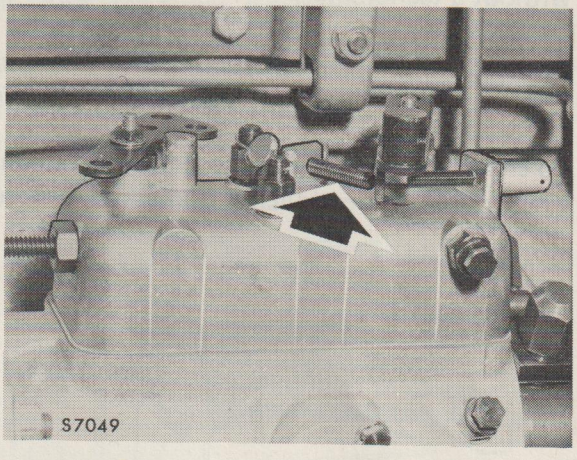
When a twin main filter is installed the one incorporating the sediment trap should be vented first.

94b FUEL INJECTION PUMP—Idling Adjustment

The engine idling speed is controlled by a screw which contacts the speed control lever on the governor housing.

On vehicles equipped with an idling control ensure that clearance exists between nipple on control wire and speed control lever before adjusting idling speed.

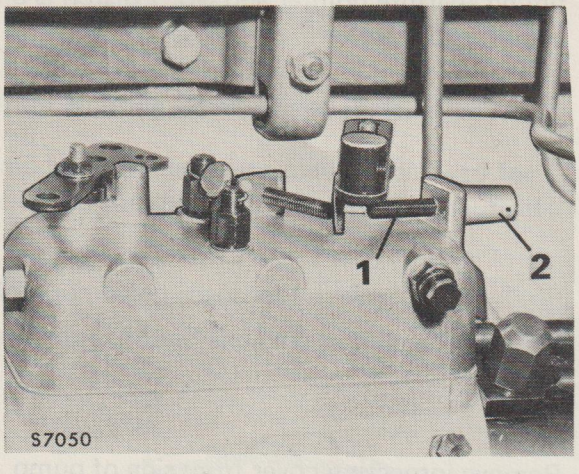
With engine at normal operating temperature, check idling speed with a tachometer and, if necessary, adjust idling stop screw to obtain specified engine idling speed.



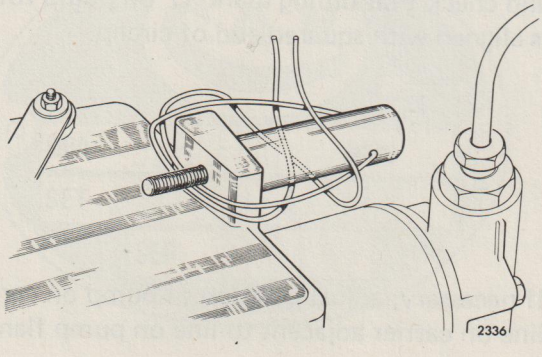
94c FUEL INJECTION PUMP—Maximum Speed Adjustment

The engine maximum speed is set by a screw (1) on the governor housing. The screw is encased by a cover (2) which is sealed against unauthorized interference.

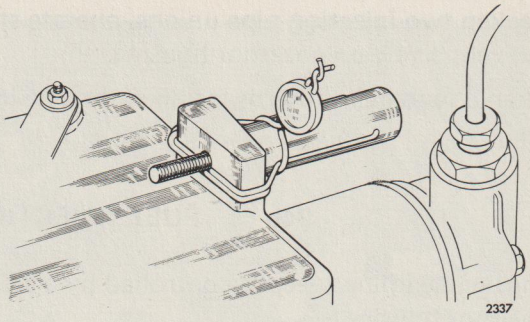
With engine at normal operating temperature move speed control lever by hand to the maximum speed position and check engine speed with a tachometer. If necessary break seal, remove cover and adjust screw to obtain specified maximum speed.



After completing adjustment, install cover and retain with wire as shown.



Pull wire tight before twisting ends together and installing seal. Seal must trap twist in wire.

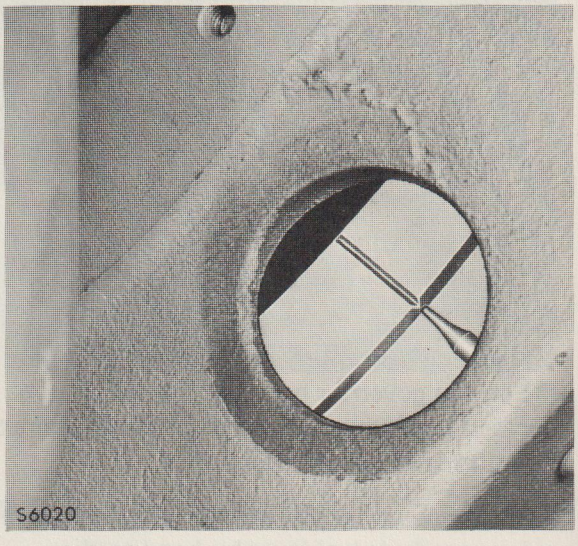


Specified maximum speed must not be exceeded, therefore adjustment must not be attempted without a tachometer.

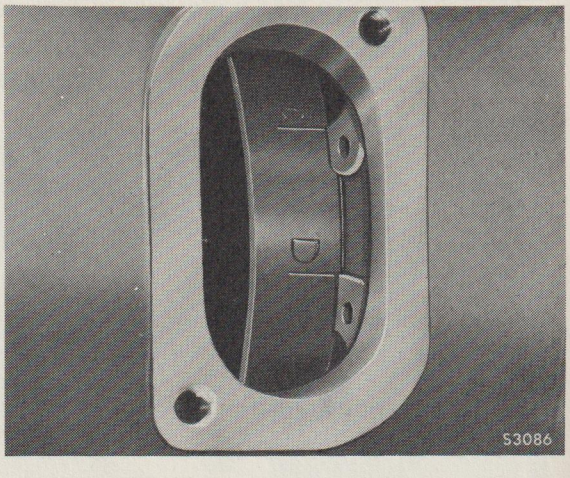
94d FUEL INJECTION PUMP–Timing Check

To check the accuracy of the timing marks on the pump and carrier flanges, or after installing a new pump carrier which is unmarked, proceed as follows:

Turn engine in normal direction of rotation until flywheel timing mark is aligned with timing aperture pointer and No. 1 piston is on compression stroke.



Remove inspection cover from side of pump and check that timing mark 'D' on pump rotor is aligned with squared end of circlip.



If necessary, adjust position of pump on carrier, ensuring backlash is eliminated, and scribe a line on carrier adjacent to line on pump flange.

94e FUEL INJECTION PUMP—Timing Circlip Setting

If, after checking the pump to engine timing, the engine still appears to be incorrectly timed, the circlip in the pump may be incorrectly positioned.

To verify circlip setting, injection pump must be removed and thoroughly cleaned externally.

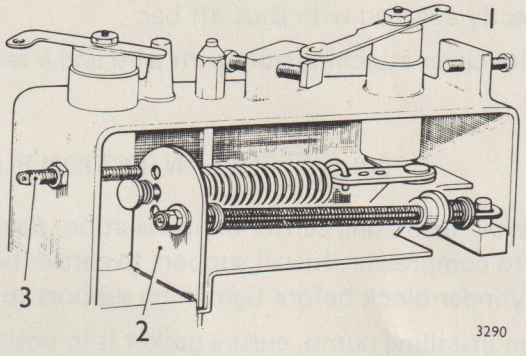
Connect No. 1 delivery port and the port diametrically opposite, by means of a stirrup pipe, to an injector testing machine.

Remove pump inspection cover and pressurize system to not more than 30 atmospheres. Turn pump drive shaft in direction indicated by arrow on pump identification plate until resistance is felt. If timing mark 'D' on pump rotor does not align with squared end of circlip, reposition circlip.

94f FUEL INJECTION PUMP—Anti-stall Screw Adjustment

The governor linkage incorporates an adjustable anti-stall screw that is threaded in the governor housing and contacts the governor control arm in the minimum fuel position.

To adjust anti-stall screw (3), back-off screw until clear of governor arm (2). With engine at normal operating temperature, check and if necessary adjust idling speed. Disconnect accelerator pedal linkage. Hold idling speed control lever (1) against idling stop and adjust anti-stall screw until engine speed shows a slight increase. Back-off screw gradually until idling speed returns to normal and back-off a further third of a turn. When connecting accelerator pedal linkage, check that control lever fully returns.



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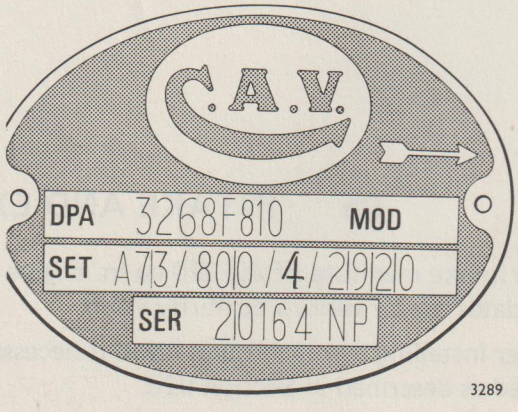
94g FUEL INJECTION PUMP—Governor Housing Removal and Installation

The governor housing, which is secured to the pump body by two nuts, may be removed for the purpose of renewing the gasket or the O-ring seals on the speed control lever and shut-off lever spindles.

Exterior of pump must be thoroughly cleaned before removing governor housing.

Before withdrawing governor housing, remove speed control lever and ease spindle downwards while lifting housing.

Check that location of governor spring in speed control lever link and governor control arm is in accordance with seventh digit of setting code stamped on pump name plate.



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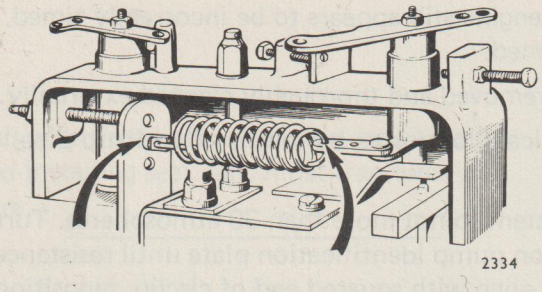
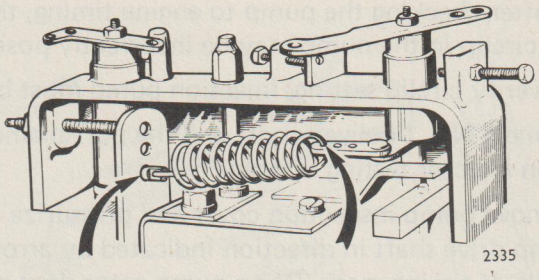




Spring location '4' is shown on the left and location '7' on the right.

Before installing cover, position shut-off spindle so that locating dog on its base is adjacent to side of cover nearest engine.

When installing cover ensure that dog on shut-off spindle locates in recess in shut-off bar. Tighten cover securing nuts to specified torque.

Check operation of governor linkage by moving shut-off lever to 'engine running' position then fully open and release speed control. Move shut-off lever to 'shut-off' position when speed control should return to idling position. A malfunction indicates that shut-off spindle is not correctly engaged with shut-off bar.

Secure cover attaching nuts with wire and a seal. Vent fuel injection pump.

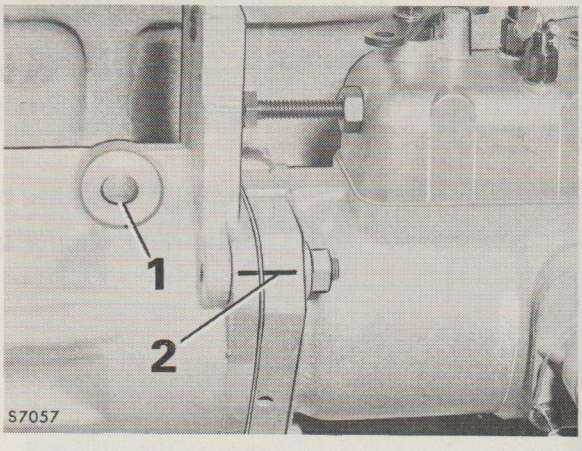
94h FUEL INJECTION PUMP—Pump and Carrier Installation

To avoid distorting carrier on installation, slacken carrier support bolts before attaching carrier to compressor. Install support to carrier bolt finger tight. Tighten bolts securing support to cylinder block before tightening support to carrier bolt to specified torque.

When installing pump, ensure gasket is in position and rotate pump shaft so that master spline on pump shaft aligns with timing pin in pump coupling. Do not use excessive force or timing pin may shear.

Align timing marks (2) on pump mounting flange and carrier.

Pour an eighth of a pint of engine oil into carrier through filler plug hole (1) to ensure initial lubrication of pump coupling.



95 INTAKE AND EXHAUST MANIFOLDS

The intake manifold of the 220 cu in. engine incorporates the venturi housing which accommodates the air venturi butterfly valve.

After installing manifold, check and if necessary adjust engine idling speed and maximum speed as described in Section 92d.

The exhaust manifold comprises a one piece casting which is secured to the cylinder head by bolts or studs and nuts depending on engine application. The threads of these bolts and studs should be smeared with Loctite Grade AVV before installation.

Exhaust manifold attachment faces should be thoroughly cleaned and, on 466 cu in. engines, liberally coated with Wellseal jointing compound, before installation. No exhaust manifold gaskets are used.

FUEL AND EXHAUST—Gasoline Engines

ACCELERATOR PEDAL LINKAGE 153

AIR CLEANER 153

FUEL PUMP 153

ZENITH 34VN CARBURETTER 154

ZENITH 37VNR CARBURETTER 157

ZENITH 48VIR CARBURETTER 159

INTAKE AND EXHAUST MANIFOLDS 162

CRANKCASE VENTILATOR VALVE 163

The fuel system of the 214 and 300 cu in. gasoline engines includes a Zenith downdraught carburetter, a diaphragm-type fuel pump and an oil-bath air cleaner.

A Zenith 34VN carburetter is used on the 214 cu in. engine in CDD, CDJ and CDL models. All other models powered by the 214 cu in. engine are equipped with a Zenith 37VNR unit. On the 300 cu in. engine a Zenith 48VIR carburetter is used.

The intake and exhaust manifolds are bolted together at their centre to provide a hot-spot to pre-heat the fuel/air mixture. On the 300 cu in. engine, the exhaust manifold comprises a centre section and two adjoining outer branches.

96 ACCELERATOR PEDAL LINKAGE

The accelerator pedal linkage should be adjusted so that the carburetter throttle flap is fully open with the accelerator pedal 0.50 in. above the toe panel or pedal stop.

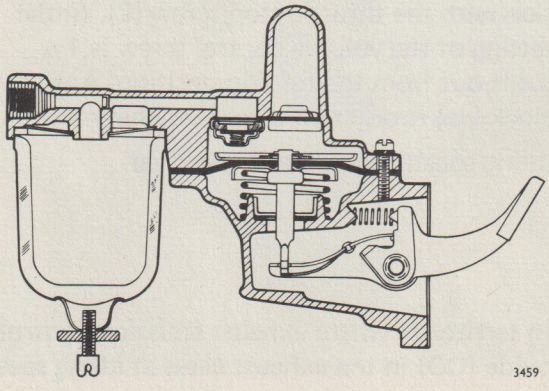
Adjustment of the linkage is achieved by repositioning the throttle control lever on the cross shaft.

97 AIR CLEANER

The oil-bath air cleaner used on the 214 and 300 cu in. engines is similar to that described for the 220 and 330 cu in. diesel engines in Section 84.

98 FUEL PUMP

The fuel pump used on the 214 and 300 cu in. engines is similar to that described for the 330 cu in. diesel engine in Section 88 except that it is not provided with a hand priming lever. The pump cover is equipped with a filter screen which is enclosed in a glass bowl.



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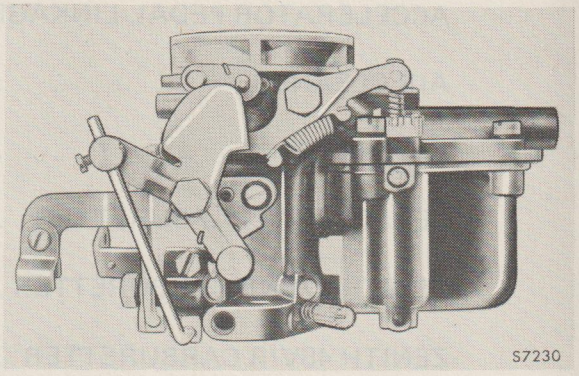
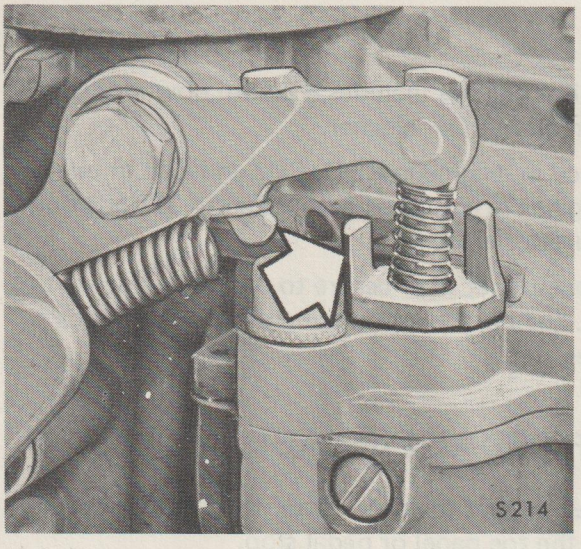
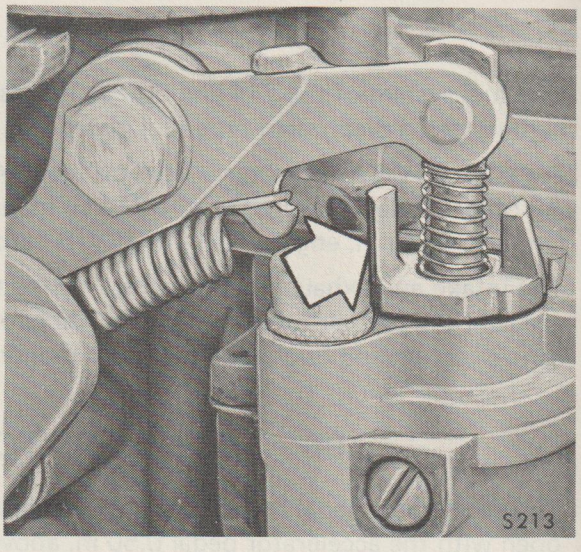
99 ZENITH 34VN CARBURETTER

The Zenith 34VN carburetter is of the down-draught type incorporating an acceleration pump and a diaphragm-type economy device.



99a ZENITH 34VN CARBURETTER—Pump Stroke Setting



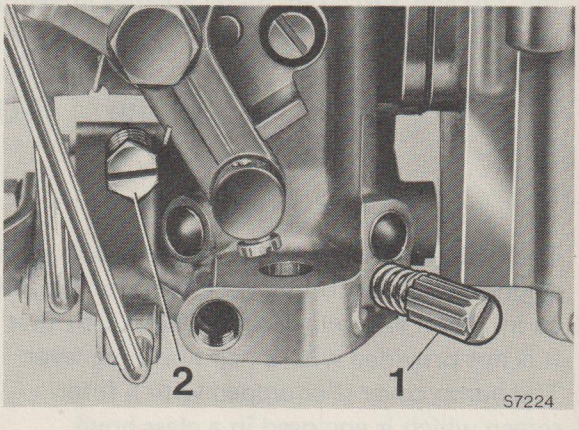


Position pump rod spring-loaded block with smaller projection under operating lever in winter or cold climates (left). Reverse position of block in summer or warm climates (right).

99b ZENITH 34VN CARBURETTER—Idling Adjustment

Carburetter idling adjustment is carried out with the volume control screw (1) is conjunction with the throttle stop screw (2). Initial setting of the volume control screw is 1¼ turns out from the fully-in position. Anti-clockwise rotation of screw enriches mixture.

Idling speed should be as specified.



In territories where exhaust emission control regulations apply, the percentage of carbon monoxide (CO) in the exhaust gases at idling speed should be 2.0—3.0% at operating temperature.

Should smooth idling be unobtainable at the values quoted, engine condition i.e. ignition timing, spark plugs, valve clearances, etc. should be checked.

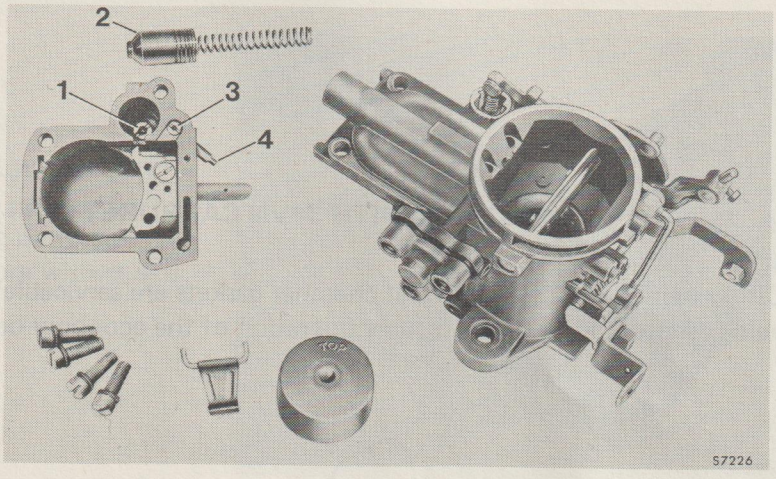
99c ZENITH 34VN CARBURETTER—Fuel Level Check

Before removing float chamber bowl to check fuel level, run engine to stabilize fuel level in bowl.

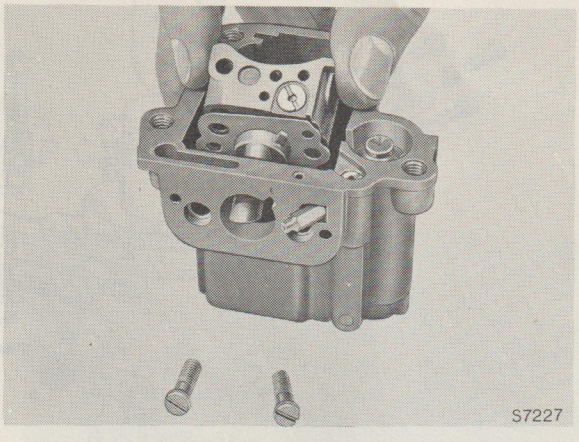
Disconnect fuel pipe to avoid extra fuel entering bowl during bowl withdrawal from carburetter. Remove bowl, taking care not to spill any fuel, and remove float.

Fuel level should be as specified, measured from the top surface of the bowl when horizontal.

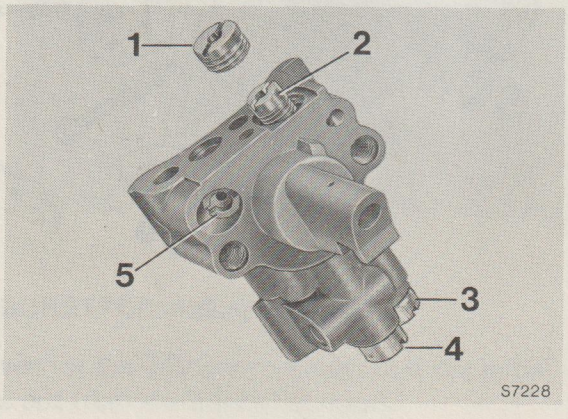
99d ZENITH 34VN CARBURETTER—Disassembly



Remove float chamber for access to acceleration pump piston (2), pump check valve (1), pump release ball valve (3) and pump jet (4).



Emulsion block may be withdrawn after removing securing screws.

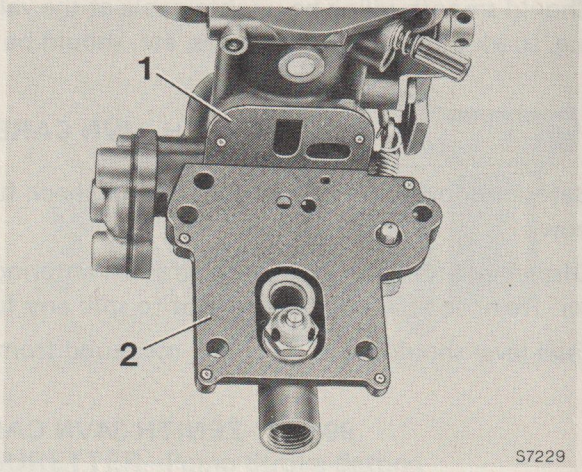


Emulsion block details

1. Slow running jet air bleed plug
2. Slow running jet
3. Compensating jet
4. Main jet
5. Emulsion block ventilation screw

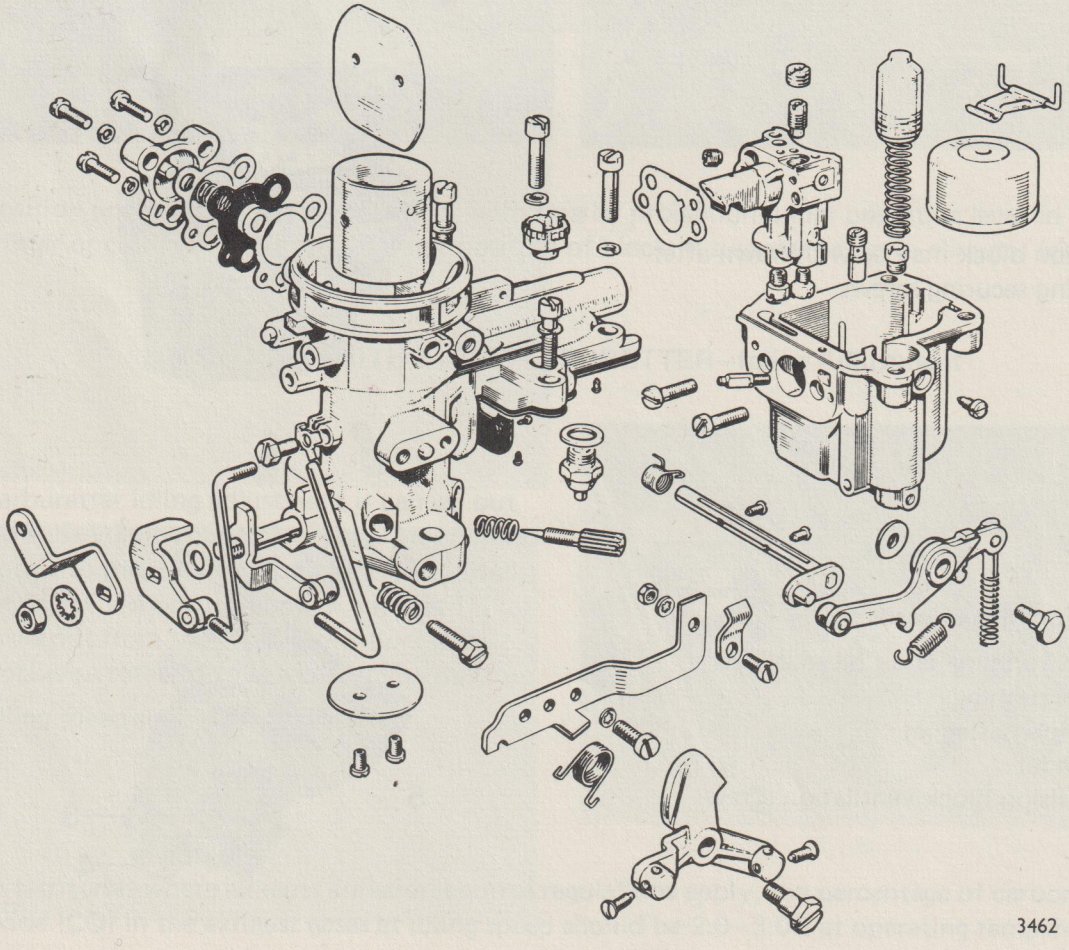
99d ZENITH 34VN CARBURETTER – Disassembly (contd)

Float chamber gaskets (1) and (2) are retained by locating pins.

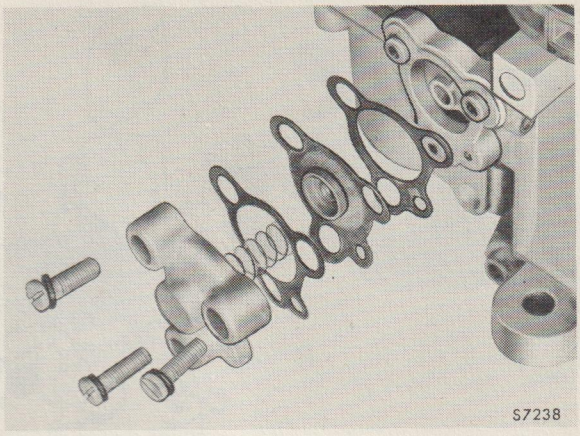


99e ZENITH 34VN CARBURETTER–Reassembly

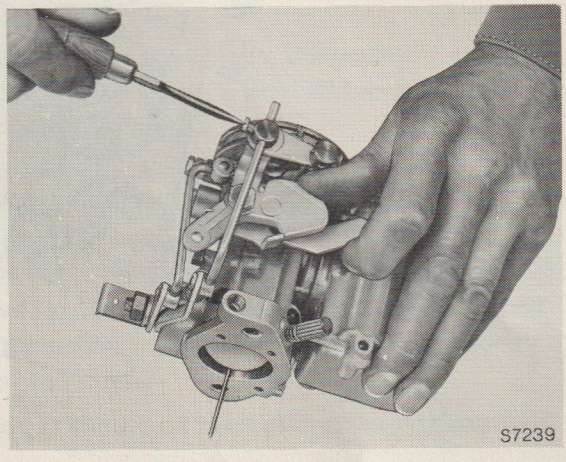
On reassembly ensure both float chamber gaskets are servicable to ensure an air-tight joint, this being essential for the satisfactory operation of the economy device.



When assembling economy device, install diaphragm with flat face of disc facing carburetter body. Install spring in cover and tighten cover screws evenly.

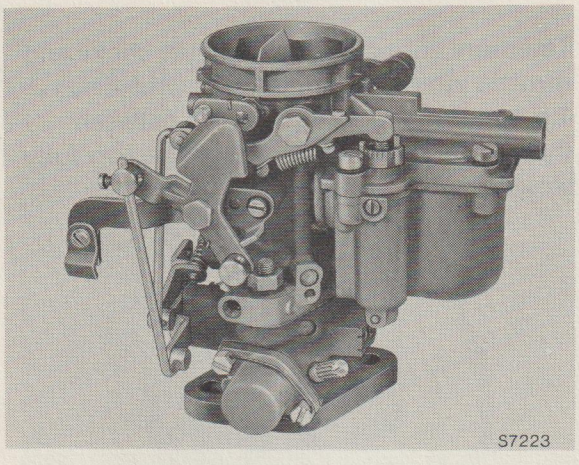


To ensure correct fast idle, adjust choke and throttle interconnecting rod to provide a 1.2 mm (No. 56 drill) clearance between throttle flap and carburetter bore with choke flap fully closed.



100 ZENITH 37VNR CARBURETTER

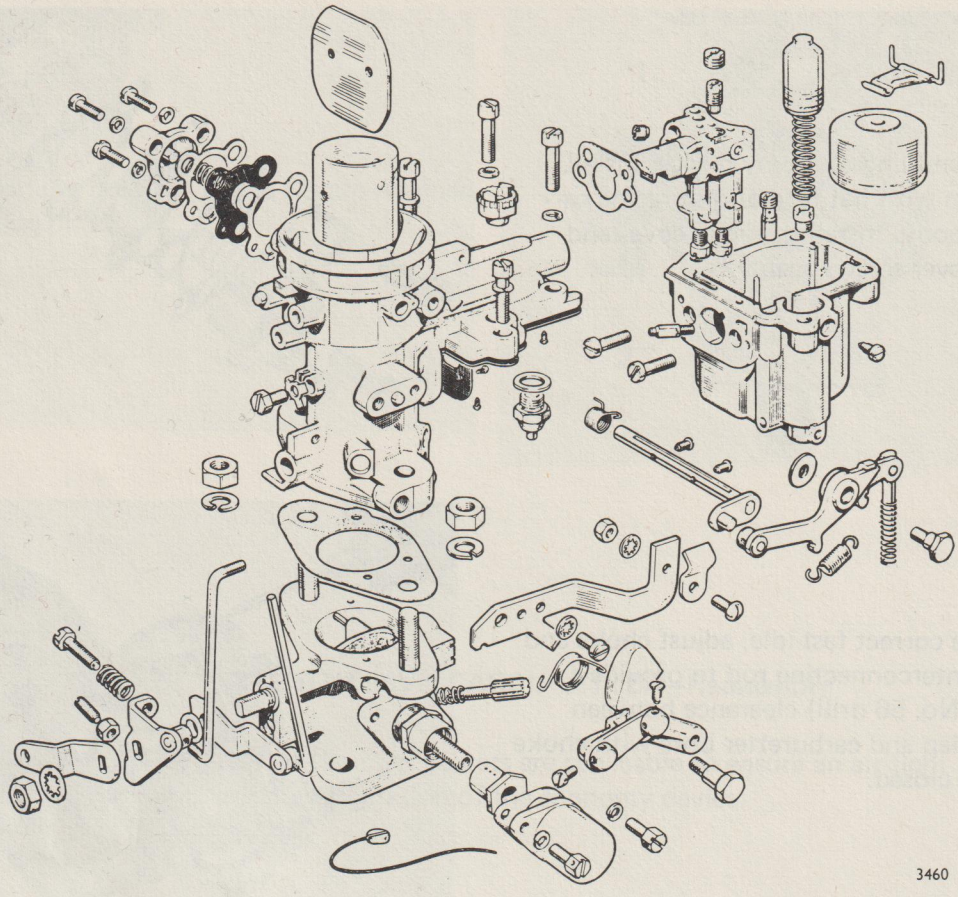
The Zenith 37VNR carburetter is similar to the 34VN unit except for choke tube and jet differences. It also incorporates a governor-controlled throttle barrel.



100a ZENITH 37VNR CARBURETTER—Idling Adjustment

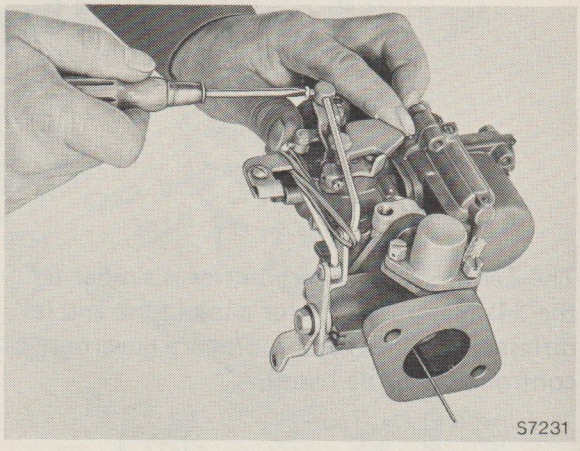
Idling adjustment procedure is similar to that given for the 34VN unit except that the initial setting for the volume control screw is two turns out from the fully-in position.

100a ZENITH 37VNR CARBURETTER – Idling Adjustment (contd)



100b ZENITH 37VNR CARBURETTER–Fast Idle Adjustment

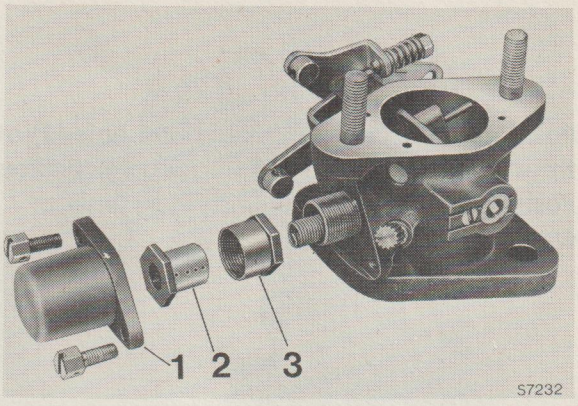
To ensure correct fast idle, adjust choke and throttle interconnecting rod to provide a 1.5 mm ($\frac{1}{16}$ in. drill) clearance between throttle flap and barrel with choke flap fully closed.



100c ZENITH 37VNR CARBURETTER–Governor Adjustment

The governor should be set to operate at 3400 rev/min. If the governor has been disturbed the cut-off point should be checked whilst the vehicle is being driven on the road, using an electric tachometer to determine engine speed.

To adjust, remove governor cover (1). Hold regulator sleeve outer hexagon (2) and rotate tension nut (3) clockwise. If, when carrying out the adjustment, the tension nut cannot be screwed in far enough due to the nut contacting the face of the carburetter body, the peg in the regulator sleeve should be repositioned in the next pair of holes away from the hexagon end of the sleeve.



If, after adjustment, the governed speed rises and falls by more than 10%, further adjustment is required.

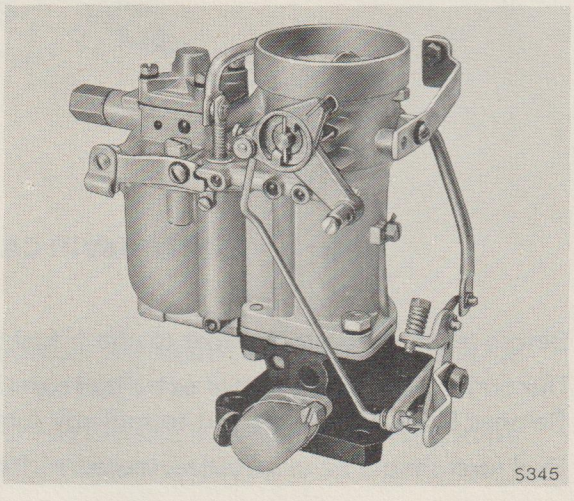
If the speed rises, the governor cut-off is too gradual. If the speed falls, the governor cut-off is too sudden. In extreme instances where the cut-off is too sudden, a slow and repeated surge of the throttle, from open to shut, may be felt and heard. To adjust:

Rotate cover through a third to one-half of a turn anti-clockwise if governed speed rises, and clockwise if governed speed falls. The cover turns the regulator sleeve and tension nut together and alters the number of effective coils of the spring. Do not rotate cover more than half a turn at a time. Should holes in cover not line up with those in carburetter body, cover must be withdrawn and repositioned over regulator sleeve. If when carrying out this adjustment the cover is fouled by the sleeve, and will not seat properly, the peg in the sleeve should be repositioned in the next pair of holes nearer the hexagonal end of the sleeve.

If the governed speed is altered by this adjustment, it should be reset as previously described.

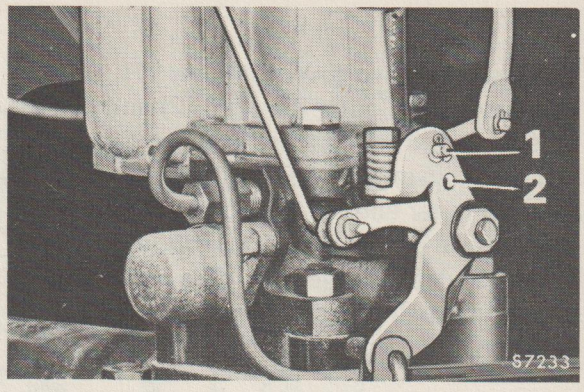
101 ZENITH 48VIR CARBURETTER

The Zenith 48VIR carburetter is of the down-draught type incorporating an acceleration pump, a diaphragm-type economy device and a governor-controlled throttle barrel.



101a ZENITH 48VIR CARBURETTER—Pump Stroke Setting

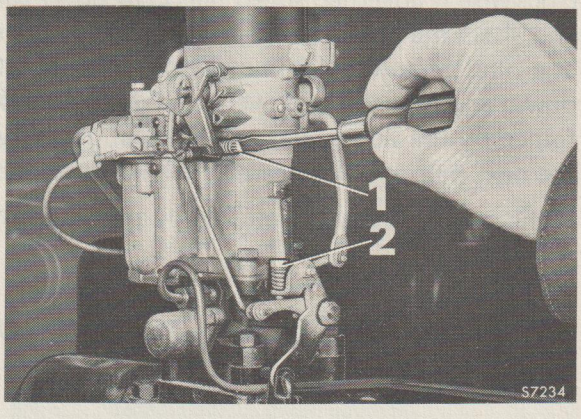
Position pump control link in outer hole (1) of throttle spindle lever in winter or cold climates. Position link in inner hole (2), in summer or warm climates.



101b ZENITH 48VIR CARBURETTER—Idling Adjustment

Carburetter idling adjustment is carried out with the air regulating screw (1) in conjunction with the throttle stop screw (2). Initial setting of the air regulating screw is two turns out from the fully-in position. Clockwise rotation of screw enriches mixture.

Idling speed should be as specified.



In territories where exhaust emission control regulations apply, the percentage of carbon monoxide (CO) in the exhaust gases at idling speed should be 2.0%—3.0% at operating temperature.

Should smooth idling be unobtainable at the values quoted, engine condition i.e. ignition timing, spark plugs, valve clearances, etc. should be checked.

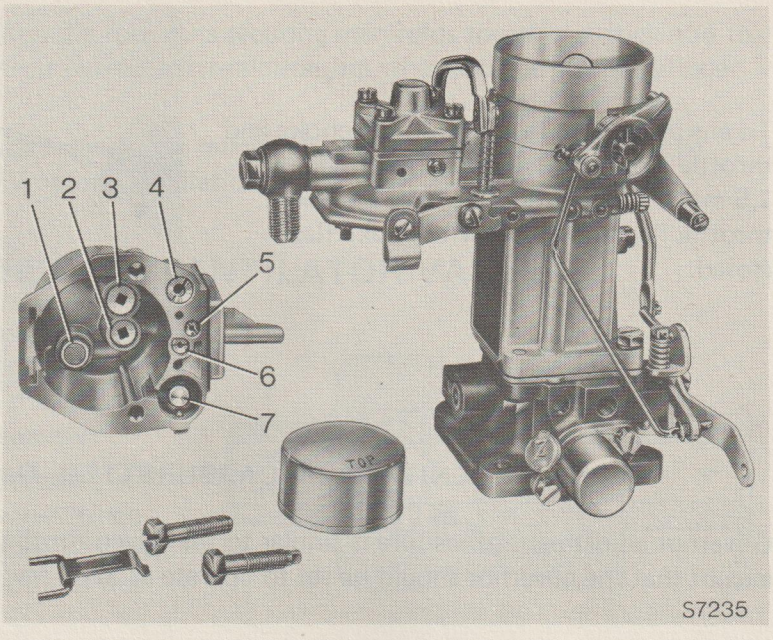
101c ZENITH 48VIR CARBURETTER—Fuel Level Check

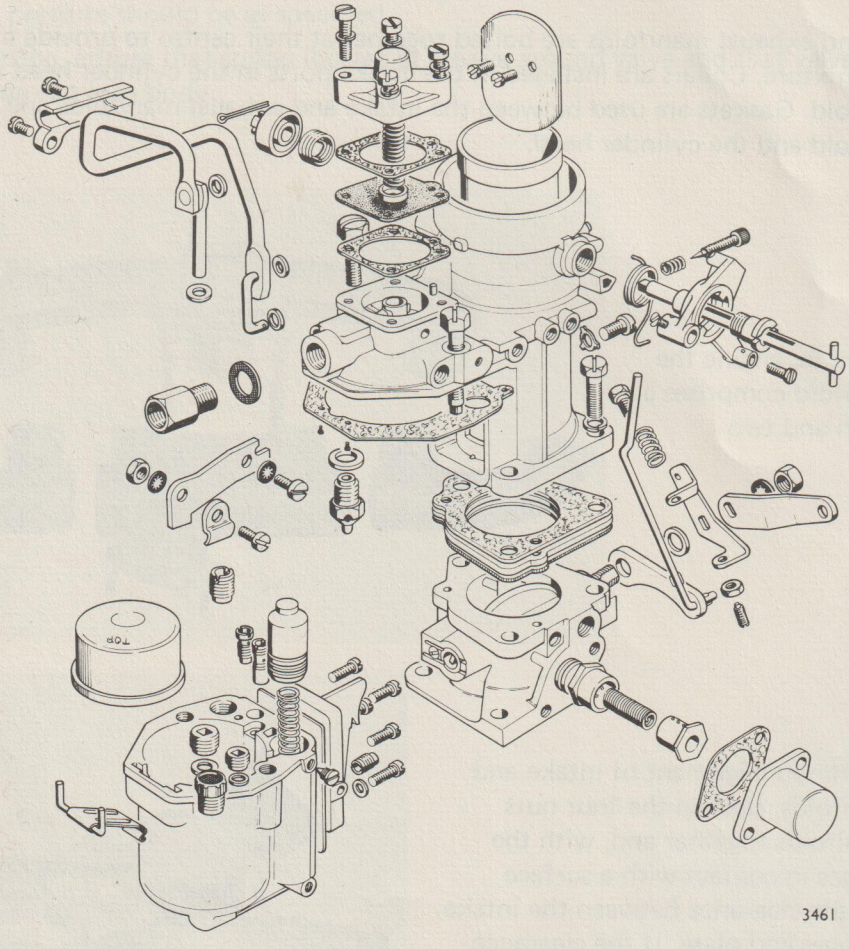
Before removing float chamber to check fuel level, run engine to stabilize fuel level in bowl.

Disconnect fuel pipe to avoid extra fuel entering bowl during withdrawal from carburetter. Remove bowl, taking care not to spill any fuel, and remove float.

Fuel level should be as specified, measured from the top surface of the bowl when horizontal.

Remove float chamber for access to acceleration pump check valve (1), main jet (2) compensating jet (3), capacity well screw (4), slow running jet (5) acceleration pump release valve (6) and pump piston (7).

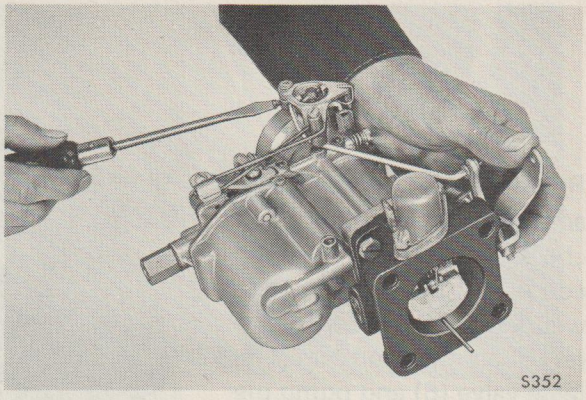




When assembling economy device, install diaphragm with flat face of disc facing carburetter body. Install spring in cover and tighten cover screws evenly.

On reassembly ensure both float chamber gaskets are serviceable to ensure an air-tight joint, this being essential for the satisfactory operation of the economy device.

To ensure correct fast idle, adjust choke and throttle interconnecting rod to provide a 1.5 mm ($^1/_{16}$ in. drill) clearance between throttle flap and barrel with choke flap closed.


S352

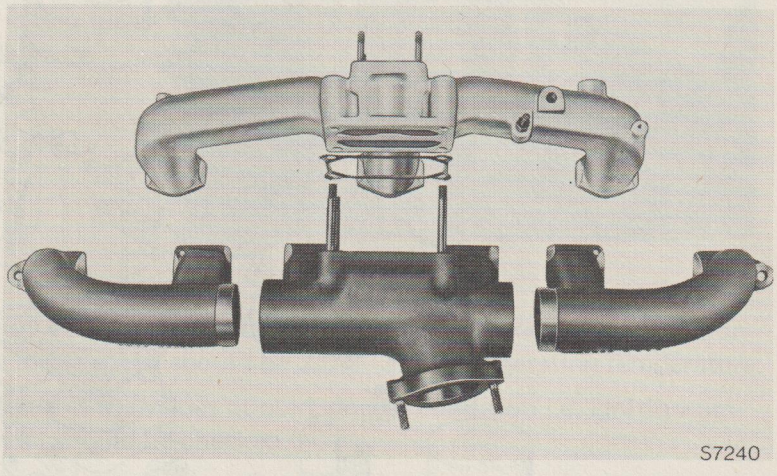
101e ZENITH 48VIR CARBURETTER—Governor Adjustment

Governor adjustment procedure is similar to that given for the 37VNR unit in Section 100c except that the governor should be set to operate at 3200 rev/min.

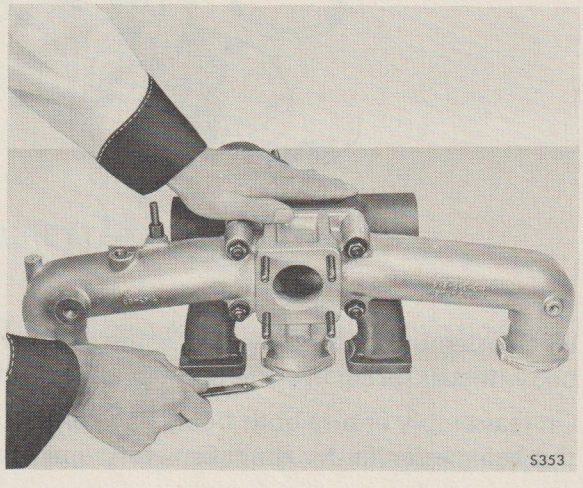
102 INTAKE AND EXHAUST MANIFOLDS

The intake and exhaust manifolds are bolted together at their centre to provide a hot spot for the air/fuel mixture. Collars are installed in the intake ports in the cylinder head to locate the intake manifold. Gaskets are used between the intake and exhaust manifolds and between the intake manifold and the cylinder head.

On the 300 cu in. engine the exhaust manifold comprises a centre section and two branches.


S7240

To check common alignment of intake and exhaust manifolds, slacken the four nuts securing manifolds together and, with the exhaust flanges in contact with a surface plate, check the clearance between the intake manifold flanges and plate. If the clearance is in excess of 0.014 in., the vertical stud holes in the intake manifold should be slightly enlarged to provide for adjustment.

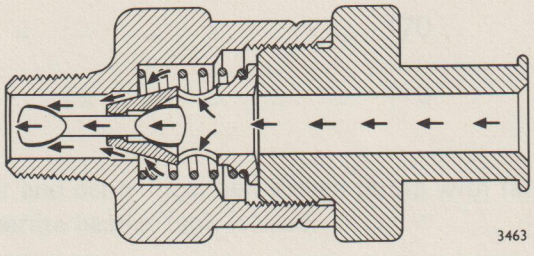

S353

Before installing manifolds, slacken the four nuts securing manifolds together sufficiently to allow the manifolds to take up their correct inter-relationship when secured to the cylinder head.

The threads of the bolts and studs securing the manifolds to the cylinder head should be smeared with Loctite Grade AVV before installation.

103 CRANKCASE VENTILATOR VALVE

A crankcase ventilator valve is used in the intake manifold of the 300 cu in. engine to regulate the flow of air through the crankcase, irrespective of manifold depression.



When the valve is open (low depression) air passes through and around the valve. When the valve is closed (high depression) air passes through the bleed hole in the centre of the valve.

Access to valve and spring is achieved by unscrewing cap from body

Valve spring pressure should be as specified.

When assembling, ensure that spring locates in groove around valve and that valve does not tilt when screwing cap into body.

COOLING SYSTEM

ANTI-FREEZE 165

THERMOSTAT 165

FAN BELTS 166

FAN 167

RADIATOR AND FILLER CAP 167

WATER PUMP 170

JOCKEY PULLEY 173

The pressurized cooling system includes a radiator and centrifugal belt-driven pump with fan. On Series E trucks and mid-engined coaches a separate header tank is used.

Drain taps are provided in the radiator bottom tank and in the left-hand side of the cylinder block.

A thermostat is housed at the front of the cylinder head.

104 ANTI-FREEZE

Vauxhall Anti-freeze is an ethylene glycol base liquid which is formulated to give protection for a period of two years, after which the system should be drained and refilled. Alcohol or methanol base anti-freeze is not recommended.

CAUTION: Ethylene glycol solution is poisonous.

If for any reason it is necessary to drain the cooling system by syphoning, do not use the mouth to start the syphoning action. Should any of the liquid be swallowed, serious illness or even death may result.

105 THERMOSTAT

Two alternative types of wax-capsule thermostat are used, AC and Western Thomson.

To check if thermostat valve opening temperature and valve fully open position are correct, use an AC thermostat tester. Thermostat should start to open at specified temperature. When water in tester boils, valve should be open approximately 0.50 in. When cold, ensure thermostat valve is completely closed otherwise engine will take longer to reach normal operating temperature.

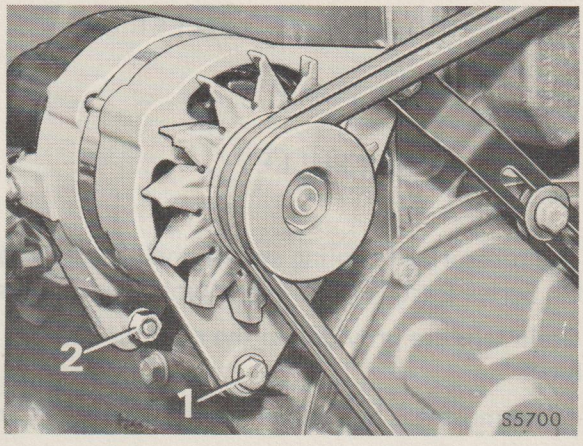
106 FAN BELTS

Fan belts are serviced in matched pairs to ensure even tension on both belts. Therefore if one belt should fail it is essential that both belts are renewed and the remaining belt discarded.

Belt tension should be as specified.

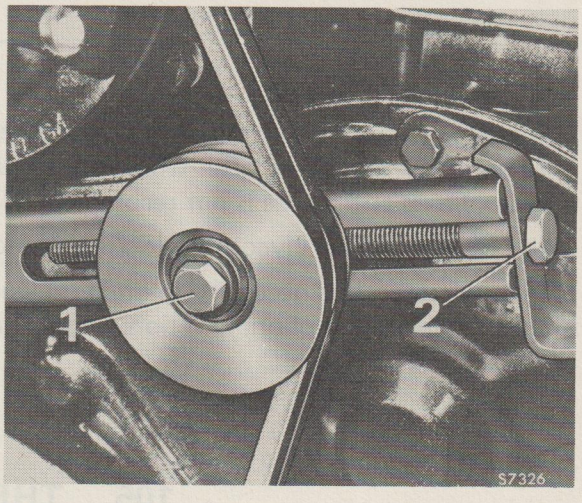
If a lever is used to move alternator when adjusting belt, it is essential that leverage is applied to drive end shield and never against stator or slip ring end shield.

It is important to note that Lucas and Delco-Remy alternators are provided with a split sliding bush in the slip ring end shield lug. This allows the alternator to be assembled to the mounting bracket without imposing side loads on the lugs. To achieve this, the drive end shield bolt (1) must be tightened before the slip ring end shield bolt (2).



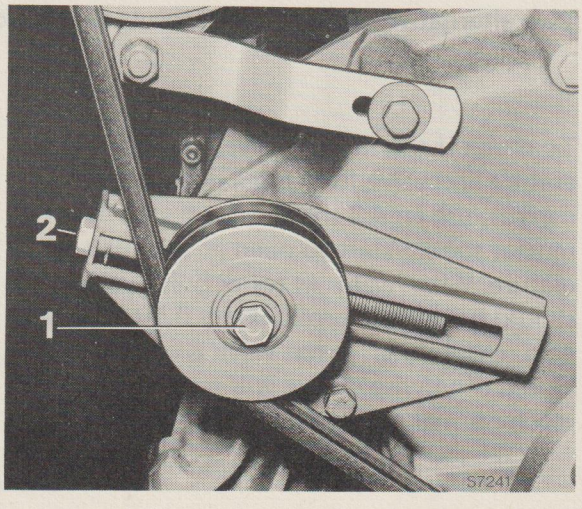
On coaches with a 300 cu in. gasoline or a 330 cu in. diesel engine, fan belt adjustment is attained by repositioning jockey pulley.

Jockey pulley retaining bolt nut (1) must be slackened before attempting to turn adjusting bolt (2).



On the 466 cu in. diesel engine, fan belt adjustment is attained by pivoting the alternator on its mountings and repositioning the jockey pulley.

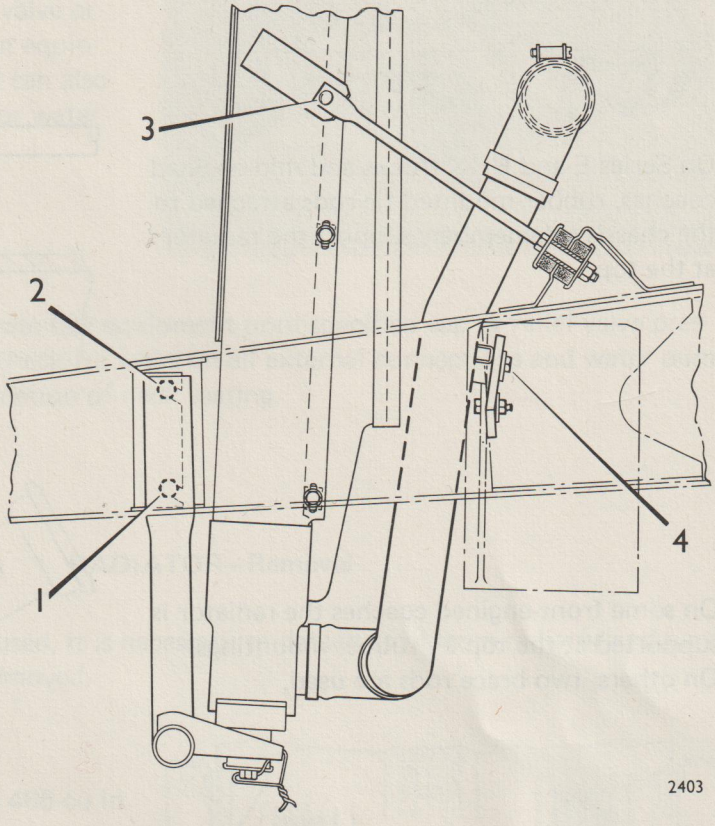
Initial slackness in the belts should be taken up by adjustment at the brace, and the jockey pulley used to obtain correct belt tension. Jockey pulley retaining bolt (1) must be slackened before attempting to turn adjusting bolt (2).



107 FAN

To suit differing cooling requirements, various combinations of fan assemblies and distance pieces are required. For details, refer to Parts Catalogues.

On Series E trucks with a 466 cu in. engine, to gain access for fan removal, remove radiator tubular support top bolts (2) and slacken bolts (1 and 3). Disconnect inlet pipe support (4) and swing bottom of radiator as far forward as possible.



On other models it may be necessary to remove the radiator before the fan can be detached.

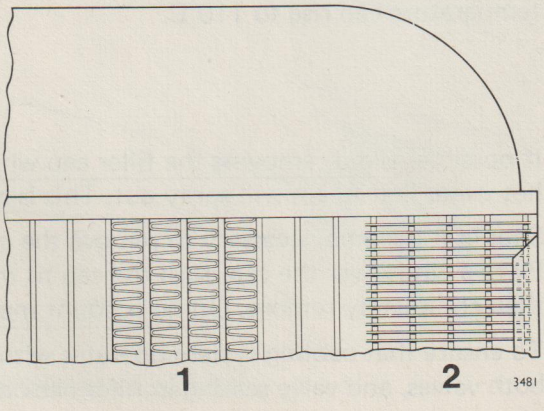
107a FAN—Inspection

If a fan blade is bent or damaged in any way, no attempt should be made to repair or re-use the damaged part. A bent or damaged fan should always be replaced with a new assembly.

It is essential that fan assemblies remain in proper balance, and proper balance cannot be assured once an assembly has been bent or damaged. A fan that is not in proper balance could fail and fly apart during subsequent use, creating an extremely dangerous condition.

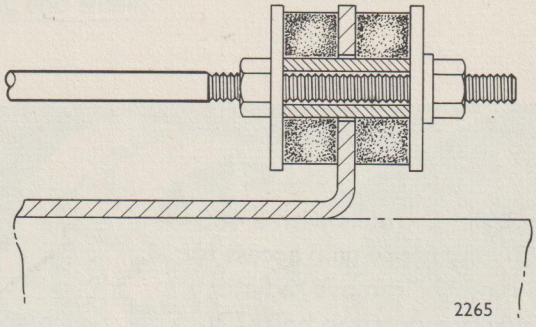
108 RADIATOR AND FILLER CAP

A radiator of fin and tube construction (2) is used on mid-engined coaches, Series E trucks with a 466 cu in. diesel engine and some vehicles built to Code 82 (increased cooling). On other trucks and coaches a radiator of tube and centre construction (1) is used.

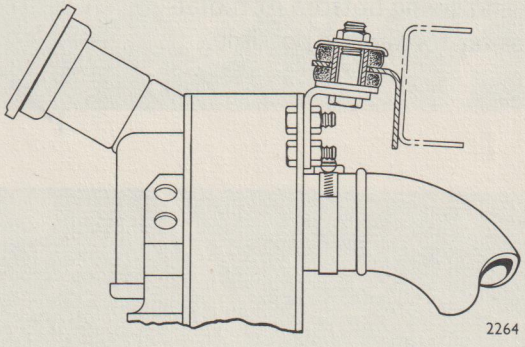


On Series C trucks the radiator is supported on brackets attached to the front wing splash-guards.

On Series E and HRX trucks and mid-engined coaches, rubber-mounted tie rods attached to the chassis sidemembers support the radiator at the top.

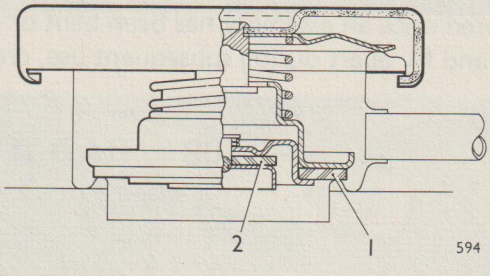


On some front-engined coaches the radiator is supported at the top by rubber mountings. On others, two brace rods are used.



The radiator bottom support brackets are integral with a U-shaped tubular frame on mid-engined coaches and Series E and HRX trucks with a 466 cu in. diesel engine. The support bracket on other Series E trucks and front-engined coaches is secured to the engine front crossmember.

The cooling system is pressurized to 7 lb/sq in. by a filler cap incorporating a pressure valve (1) which seats in the radiator or header tank filler neck, and a vacuum or vent valve (2). At this pressure, the engine operating temperature can rise to 110°C.

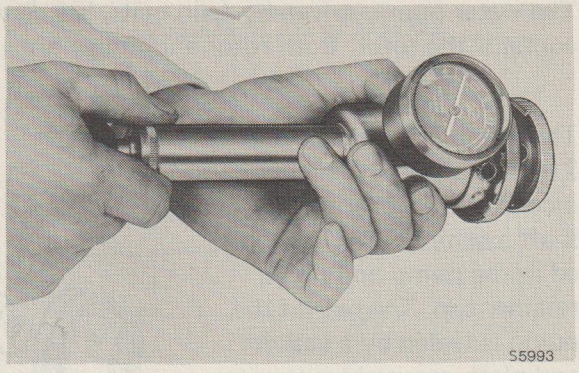


If possible, avoid removing the filler cap while the engine is at operating temperature, since hot water and steam will spray out. This is normal for all pressure-type cooling systems.

Should it become necessary to remove the cap while the engine is hot, care must be exercised. Place a cloth over the cap, turn the cap to the first detent position until all pressure is released, then completely remove. On no account must the cap be removed in one motion.

To ensure that cooling system operates within specified pressure limits, it is important that both both valves, and valve seating in filler neck are in a serviceable condition.

To check opening pressure of relief valve or filler cap pressure valve, pressure test equipment must be used. This equipment can also be used for testing cooling system for water leaks.

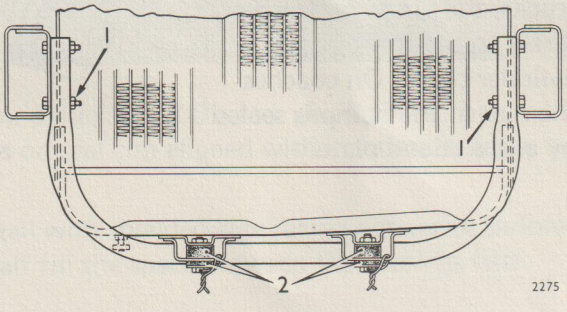


To check seating in filler neck, operate test equipment until specified cap or relief valve pressure is obtained. If pressure drops, check for leaks on all external connections and water pump before carrying out a further examination of neck seating.

108a RADIATOR—Removal

On trucks, when a radiator cowl is used, it is necessary to detach cowl from radiator and hang it over fan before radiator can be removed.

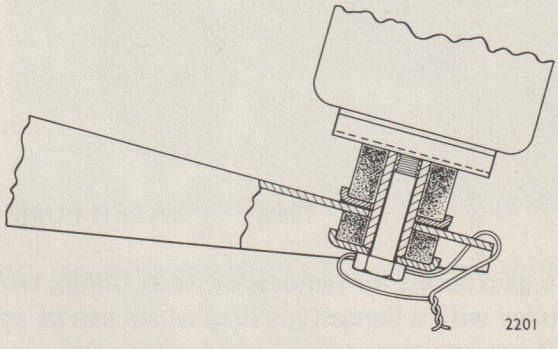
On Series E and HRX trucks with a 466 cu in. diesel engine, after removing the two lower bolts (1) and lower support insulator (2), the tubular support frame can be swung forward to allow radiator to be withdrawn downwards.



On mid-engined coaches, it is not necessary to disturb radiator support frame or to detach cowl from radiator. After removing two bolts securing steel section of overflow pipe to radiator cowl, disconnect top, bottom and overflow hoses and withdraw radiator and cowl assembly from underneath vehicle.

On front-engined coaches, radiator must be withdrawn forwards after removing radiator grille.

On all models, when installing radiator, ensure that the thicker insulators are inserted above support.

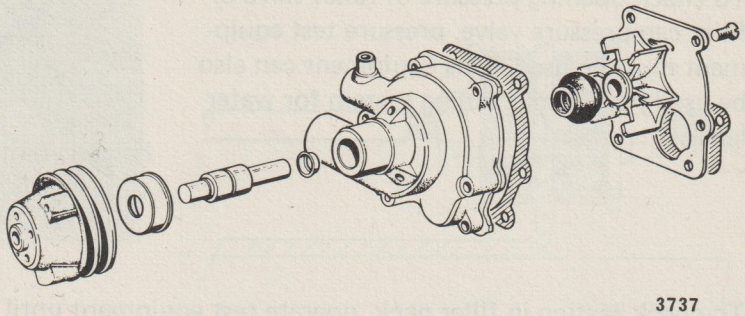


When installing a radiator cowl, ensure that it clears fan at all points.

109 WATER PUMP

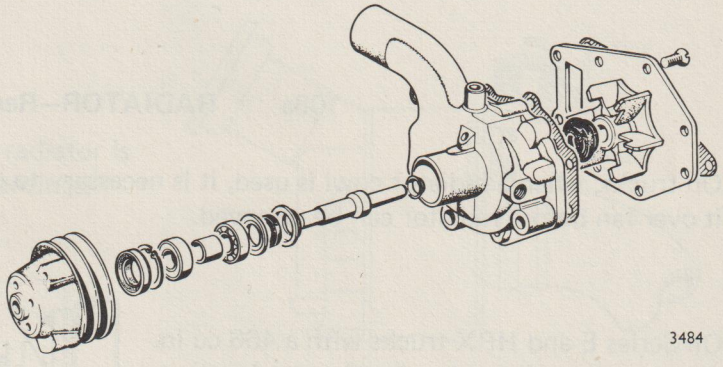
The water pump, driven by twin belts, is a centrifugal type with a self-adjusting water seal that contacts the rotor. Both rotor and pulley are a press fit on the pump shaft.

The pump installed on the 214 cu in. gasoline engine incorporates a bearing and shaft assembly which is secured in the pump body by a retainer cap. The rear of the pump is sealed by a gasket and plate, secured by countersunk set screws.



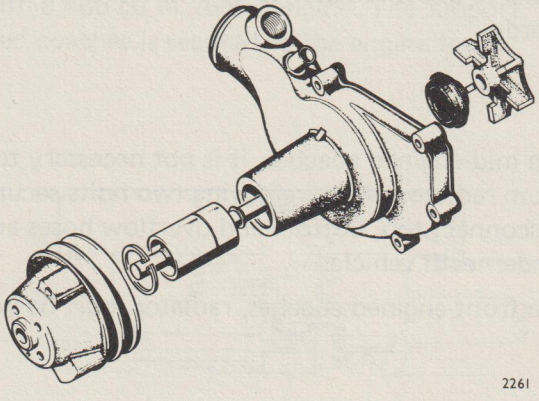
3737

The pump installed on the 220 and 330 cu in. diesel and the 300 cu in. gasoline engines incorporates a shaft supported by two single-row ball bearings separated by a collar. The shaft and bearings are retained in the pump by a circlip and protected by a felt seal at the rear and a lip-type seal at the front. On trucks, the pump is attached direct to the front of the cylinder block. On coaches the rear of the pump is sealed by a gasket and plate.



3484

The water pump of the 466 cu in. diesel engine has a bearing and shaft assembly retained in the housing by a circlip. The pump is attached direct to the front of the cylinder block.



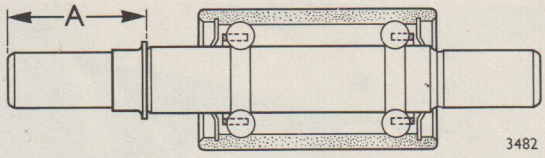
2261

109a WATER PUMP—Removal and Disassembly

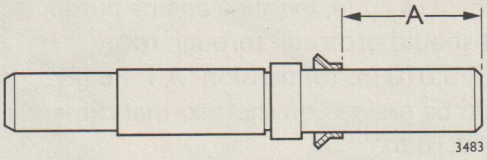
To gain access for removal of water pump, radiator and fan must be removed. Withdraw pulley with a flange-type drag which can be attached by the fan bolts.

To remove shaft and bearings, withdraw front seal where applicable, remove circlip or cup retainer at front of pump body, support pump on body and press shaft through rotor.

Should it be necessary to renew water thrower, install on shaft so that dimension 'A' is 1.50 in. on the 214 cu in. gasoline engine and 1.56 in. on the 466 cu in. diesel engine.

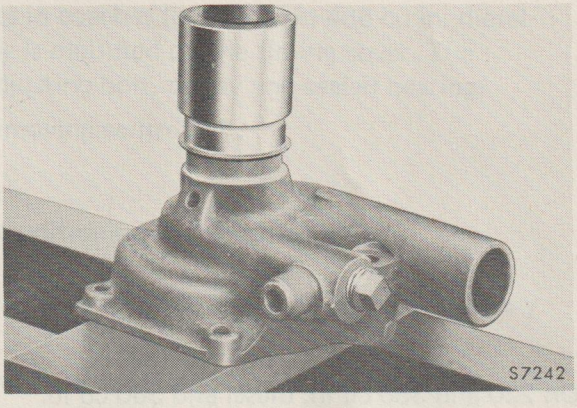


On 220 and 330 cu in. diesel and 300 cu in. gasoline engines, dimension 'A' should be 1.38 in.



The water pump shaft and bearing assembly on 214 cu in. gasoline and 466 cu in. diesel engines should be pressed into the pump body, using a sleeve with an external diameter equal to that of the bearing, until bearing contacts shoulder in body bore.

On the 214 cu in. gasoline engine pump, press a new cup retainer on to pump body using a sleeve to contact retainer periphery.

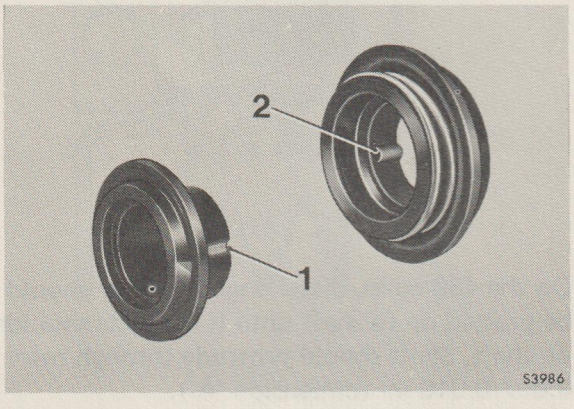


When assembling pump on the 220 and 330 cu in. diesel and 300 cu in. gasoline engines, soak rear oil seal felt in engine oil and install with pips on seal cup aligned with location in body bore.

Pack bearings with recommended grease and install with shielded side facing outwards. Before installing the distance piece and front bearing, half fill the space between the bearings with recommended grease.

Lubricate front seal lip, and install with lip facing forward and casing flush with pump body.

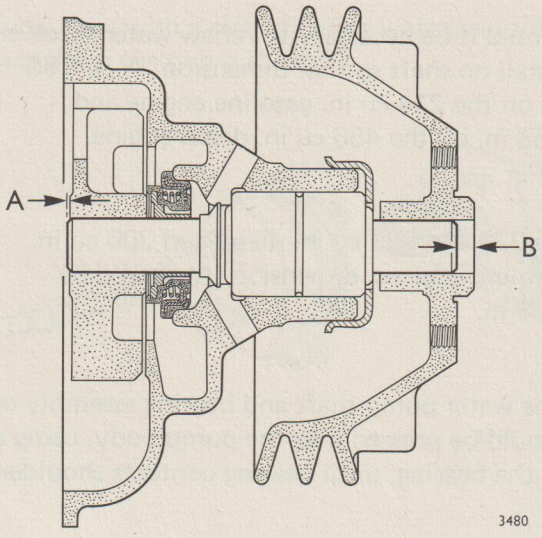
Before installing seal in body, ensure seal is correctly assembled. Grooves (1) in sleeve must engage pips (2) in casing.



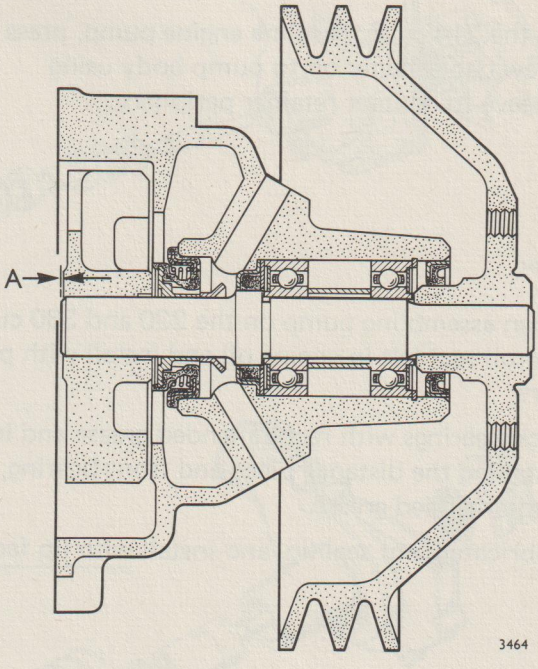
To facilitate assembly, smear periphery of seal with recommended grease. Do not grease thrust faces of seal and rotor.

When pressing rotor or pulley on to pump shaft, thrust must be taken by the shaft and not the pump body.

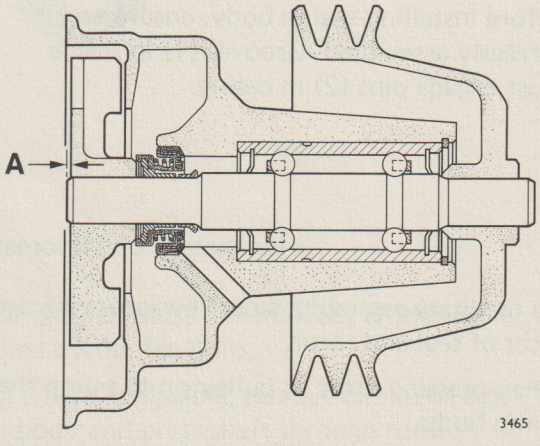
On the 214 cu in. gasoline engine pump, shaft should protrude through rotor 0.007/0.010 in. (dimension 'A'). Pulley should be pressed on shaft so that dimension 'B' is 0.16 in.



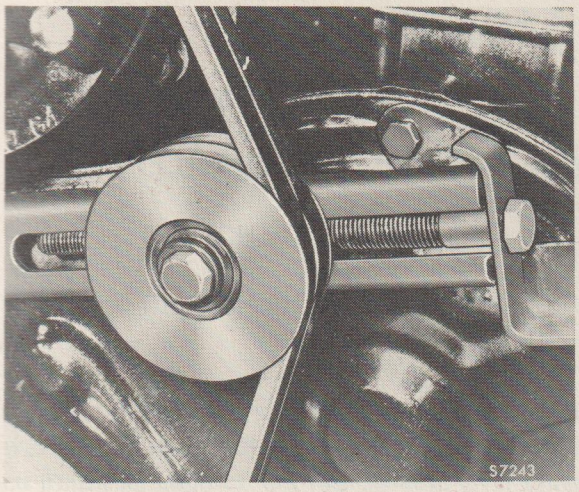
On 220 and 330 cu in. diesel and 300 cu in. gasoline engines, press pulley on shaft until it contacts bearing inner race. Shaft should protrude through rotor 0.007/0.010 in. (dimension 'A').

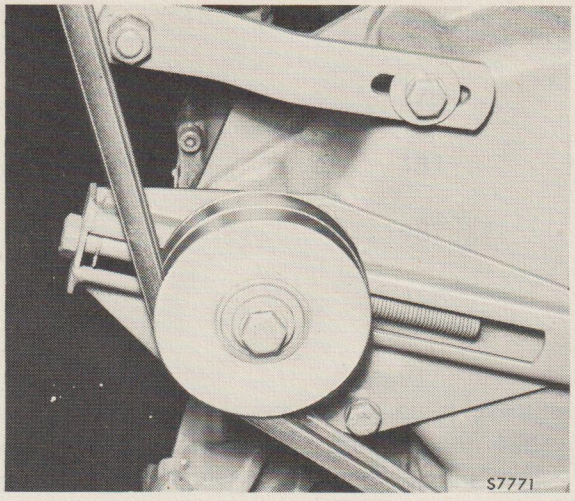


On the 466 cu in. diesel engine, pulley should be pressed on to shaft until it contacts shoulder on shaft. Shaft should protrude through rotor 0.007/0.010 in. (dimension 'A').



110 JOCKEY PULLEY





On 300 cu in. gasoline and 330 cu in. diesel engines in coaches (left) and on 466 cu in. diesel engines (right), an adjustable fan belt jockey pulley is mounted on the timing cover. The pulley assembly consists of a mounting bracket, adjusting bolt, pulley and sealed bearings.

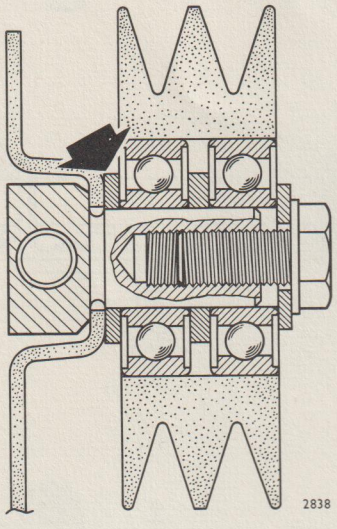
The pulley can be withdrawn from spindle after removing centre bolt.

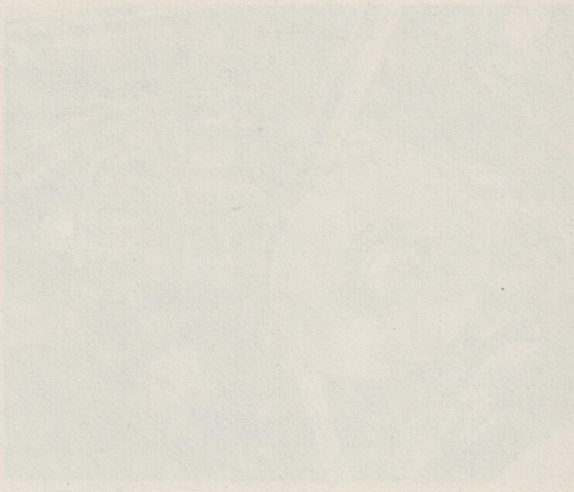
110a JOCKEY PULLEY—Reconditioning and Reassembly

Do not remove bearings from pulley unless they are to be renewed as one of the bearings may be damaged during removal.

The shielded bearings are prepacked with grease and must be pressed in individually from either side of the pulley, applying pressure simultaneously to the inner and outer races so that they locate flush with the pulley and clamp the interposed spacer.

On reassembly, ensure that the spacer is installed between pulley and mounting bracket (466 cu in. diesel engine pulley shown).





CLUTCH

CLUTCH PEDAL AND SHAFT 175

CLUTCH LINKAGE 178

CLUTCH FORK AND RELEASE BEARING 181

CLUTCH 182

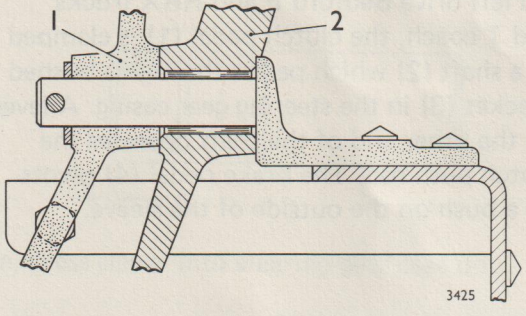
CLUTCH PILOT BEARING 186

The clutch used is a single-plate coil-spring type with three release levers on 214 cu in. gasoline and 220 cu in. diesel engines, and four release levers on 300 cu in. gasoline and 330 and 466 cu in. diesel engines. On four release lever clutches, the clutch cover is connected to the pressure plate by four drive straps.

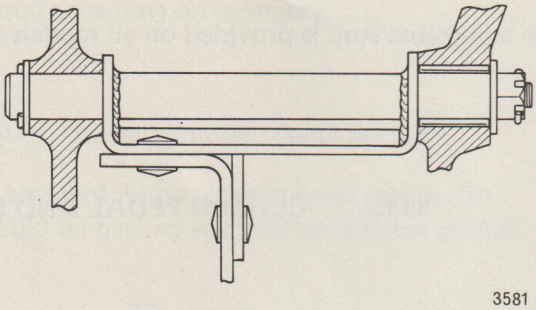
The clutch is operated by a floor pedal through push rods, clutch fork and release bearing. On YRT coach the clutch is hydraulically operated with air assistance.

111 CLUTCH PEDAL AND SHAFT

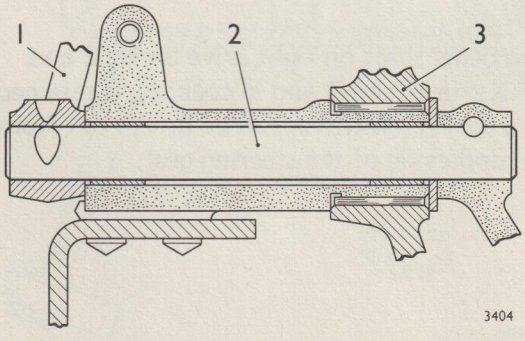
The clutch pedal (1) on right drive C trucks pivots direct on a support attached to the chassis right-hand sidemember. The brake pedal (2) is situated adjacent to the clutch pedal and pivots on rollers.



A similar arrangement is used for N and P coaches except that the pedals are located on opposite ends of a common shaft.

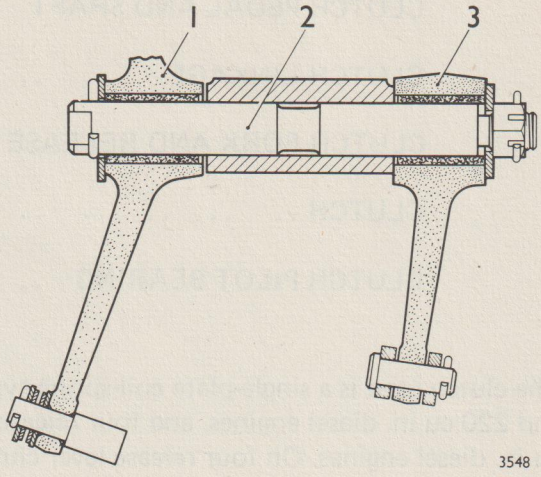


On left drive C trucks and N and P coaches the clutch pedal (1) is clamped to a shaft (2) which passes through a bushed bracket secured to the left-hand sidemember. A lever on the other end of the shaft provides an attachment for the clutch push rod. The brake pedal (3) pivots on rollers on the outside of the bracket.



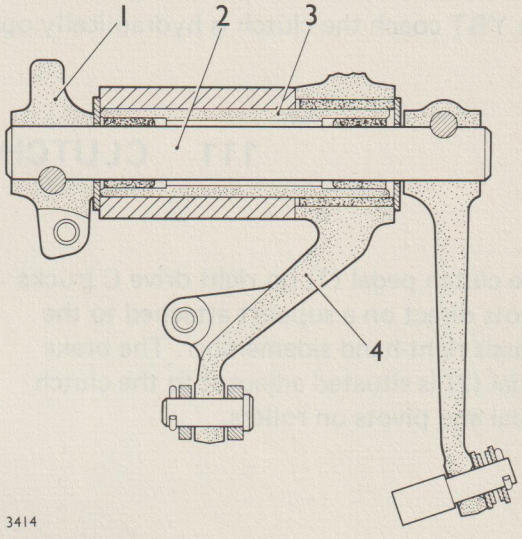
111 CLUTCH PEDAL AND SHAFT (contd)

The clutch pedal (1) and brake pedal (2) on right drive Bedford E and HRX trucks and T and Y coaches are bushed and pivot on a shaft mounted in the steering gear casing.



3548

On left drive Bedford E and HRX trucks and T coach, the clutch pedal (1) is clamped to a shaft (2) which passes through a bushed bracket (3) in the steering gear casing. A lever on the other end of the shaft operates the clutch push rod. The brake pedal (4) pivots on a bush on the outside of the sleeve.

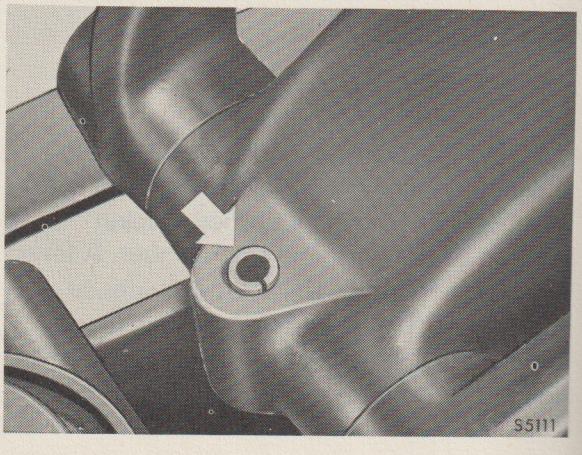


3414

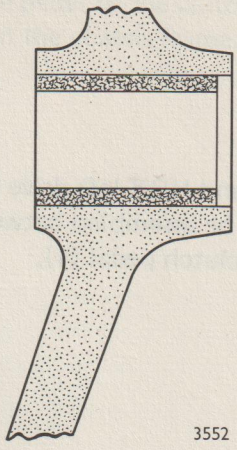
An adjustable stop is provided on all models for adjusting the pedal setting.

111a CLUTCH PEDAL AND SHAFT—Removal and Reconditioning

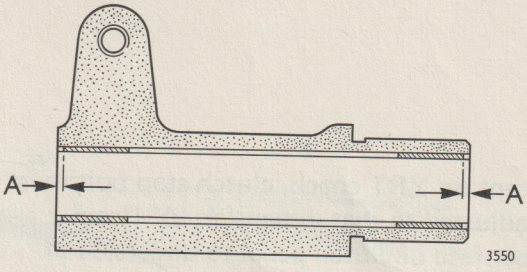
The pedal shaft on right drive Series E and HRX trucks and T and Y coaches, is retained by a spring pin which can be driven out from the underside of the steering gear.


S5111

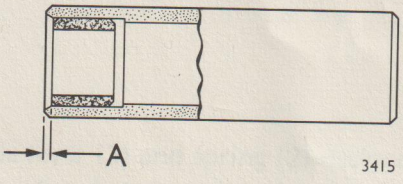
Clutch pedal bush should be pressed in until flush with outer face of pedal boss.



On left drive C trucks and N and P coaches, install replacement bushes in pedal shaft bracket so that dimension 'A' is 0.09 in. On assembly, ream bushes to provide specified clearance with shaft.



On left drive E and HRX trucks and T coaches, install replacement bushes in pedal shaft sleeve so that dimension 'A' is 0.06 in.



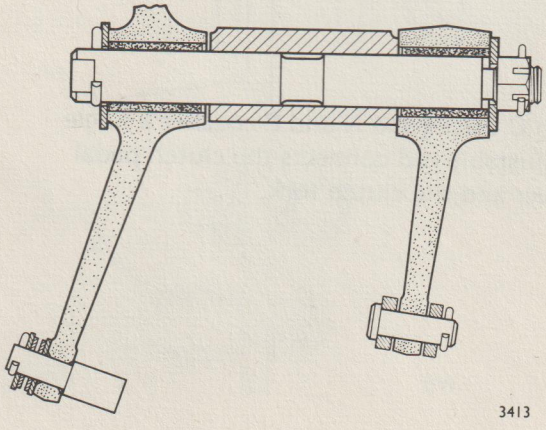
Should it be necessary to renew pedal shaft sleeve, press sleeve into steering gear case until flush with clutch pedal side.

Replacement clutch pedal and shaft bushes on E and HRX trucks and T and Y coaches are of the pre-finished non-metallic type that do not require reaming on assembly.

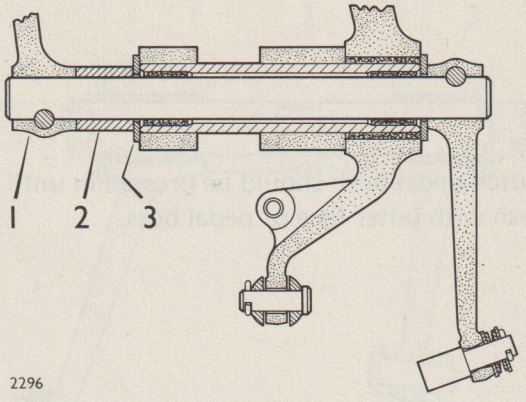
111b CLUTCH PEDAL AND SHAFT—Installation and Pedal Setting

Clutch pedal and shaft bushes should be liberally smeared with recommended grease. On models with brake pedal bearing rollers, these should be packed with recommended grease.

Excessive clutch and brake pedal side clearance on right drive Bedford E trucks (except ERT and ERV models) can be reduced by loosening the spring pin, retaining shaft in steering gear, and tightening slotted nut.

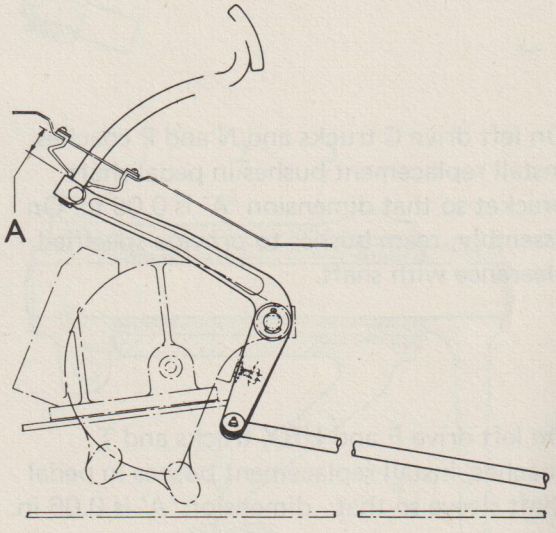


On ERT, ERV and HRX left drive trucks, spacer (2) must be assembled between washer (3) and clutch pedal (1).



2296

Except on YRT coach, clutch stop bolt must be adjusted so that dimension 'A' (from upper face of clutch pedal to underside of floor panel) is as specified.



2297

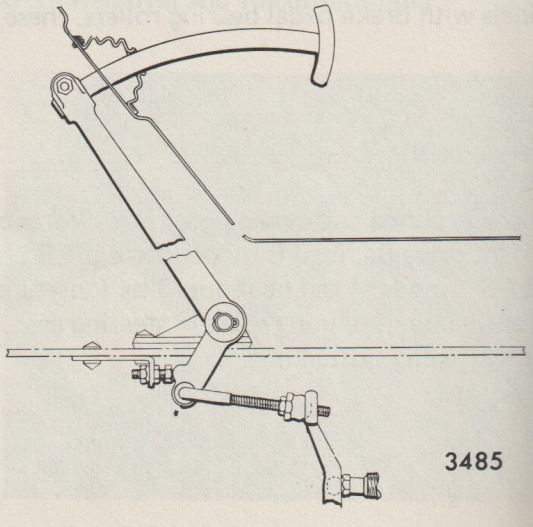
On YRT coach, the pedal setting is controlled by the master cylinder push rod.

After adjusting pedal stop bolt on YRQ coach, check angle of push rod relay lever as described in Section 112.

After reconnecting push rod to clutch pedal, check pedal or fork free travel as described in Section 112a.

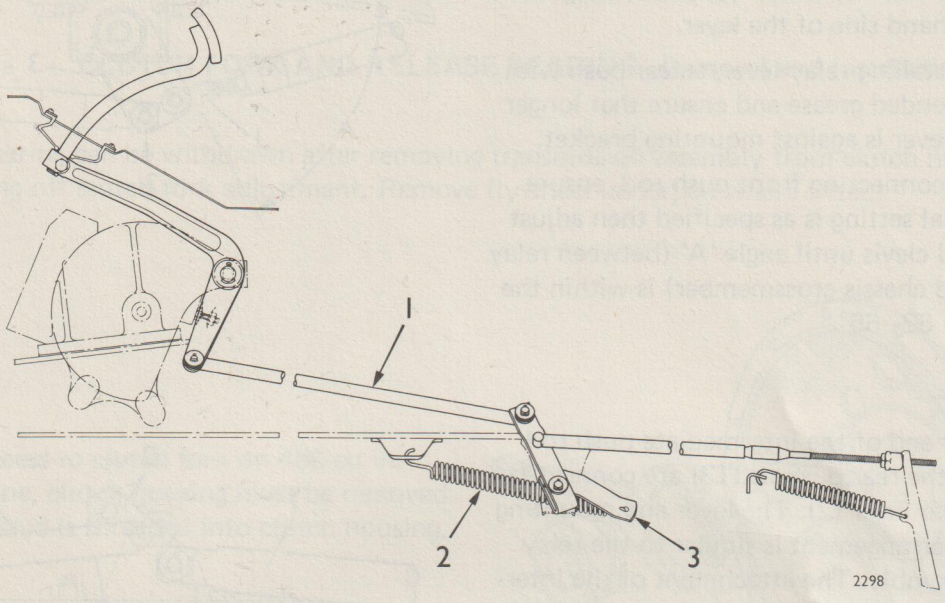
112 CLUTCH LINKAGE

On C trucks and N and P coaches a single adjustable rod connects the clutch pedal lever and the clutch fork.


3485

On all other models, except YRT coach, the linkage from the pedal to the clutch fork consists of push rods interconnected by a relay lever mounted on the chassis frame.

Adjustment is provided at the clutch fork end of the linkage.

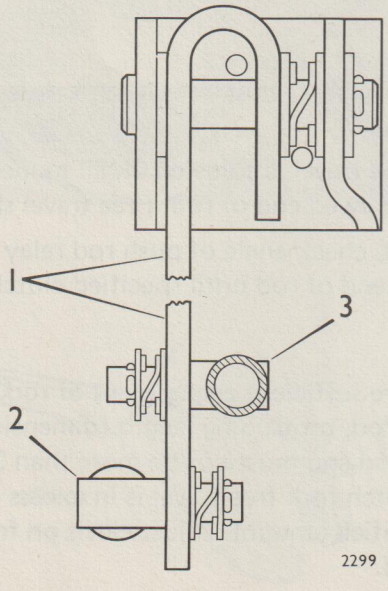


The push rod relay lever on trucks incorporates a toggle lever (3) and spring (2) designed to assist clutch pedal operation. The spring is anchored to a bracket riveted to the chassis frame or on later models to the front spring bump stop bracket.

Forward push rod (1) is connected to upper hole in relay lever, with split pin towards the engine.

On T coach, the push rod relay lever is attached to a bracket bolted to a chassis frame crossmember bracket.

Relay lever must be assembled with its extended side (1) towards engine. Forward push rod (3) must be connected to upper hole in lever, with split pin towards the engine, and rear push rod (2) from the opposite side.'

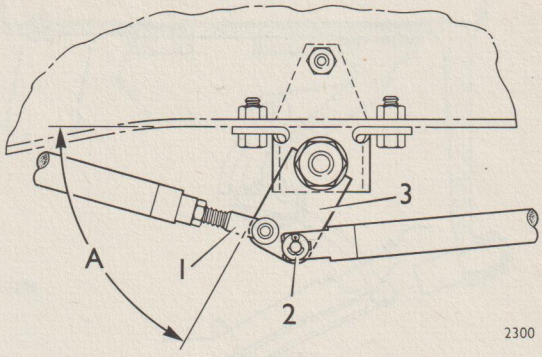


On YRQ coach the front push rod incorporates an adjustable clevis (1) which is connected to a bushed relay lever (3). The lever rotates on a bolt welded to a bracket on the chassis frame sidemember.

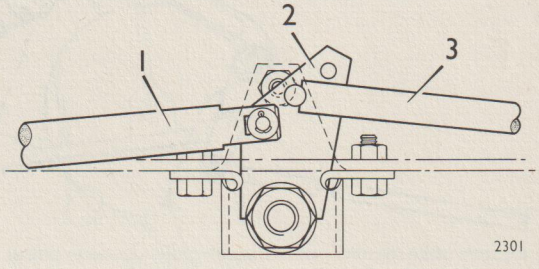
The intermediate push rod is connected to the relay lever by a stud (2) protruding from the left-hand side of the lever.

When installing relay lever, smear bush with recommended grease and ensure that longer boss of lever is against mounting bracket.

When reconnecting front push rod, ensure that pedal setting is as specified then adjust push rod clevis until angle 'A' (between relay lever and chassis crossmember) is within the limits of 62–65°.



The rear end of the intermediate push rod (1) and the rear push rod (3) are connected to an idler lever (2). The lever and mounting bracket arrangement is similar to the relay lever assembly. The attachment of the intermediate push rod is the same at both ends, but the rear push rod is assembled from the left-hand side and to the centre hole in the lever.



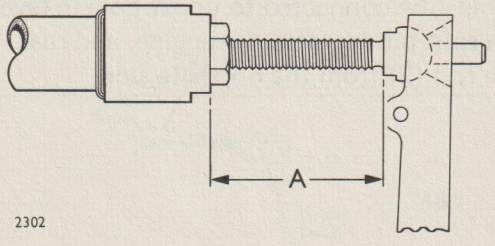
112a CLUTCH LINKAGE—Pedal or Fork Free Travel

Before adjusting clutch pedal or fork free travel, check clutch pedal setting as previously described.

Pedal free travel is adjusted on all models except YRQ coach by rotating push rod adjusting nut or screwed end of rod. Free travel should be as specified.

On YRQ, check angle of push rod relay lever as previously described. If necessary adjust screwed end of rod until specified clutch fork free travel is obtained.

To ensure sufficient engagement of rod end in push rod, protruding length (dimension 'A') of rod end must not be more than 3.70 in. If clutch fork free travel is in excess of the specified amount, adjust clevis on front push rod.



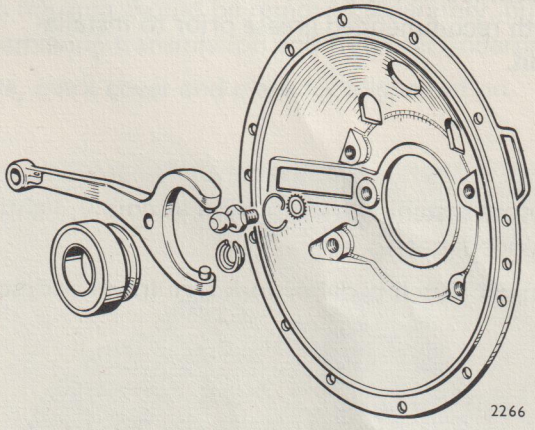
113 CLUTCH FORK AND RELEASE BEARING

The clutch fork pivots on a ball support mounted in the clutch housing. Two pins incorporated in the fork jaw engage a grooved sleeve of the release bearing which slides on the tubular extension of the transmission front cover. The bearing is of the single-row ball type and is packed with lubricant and sealed during manufacture.

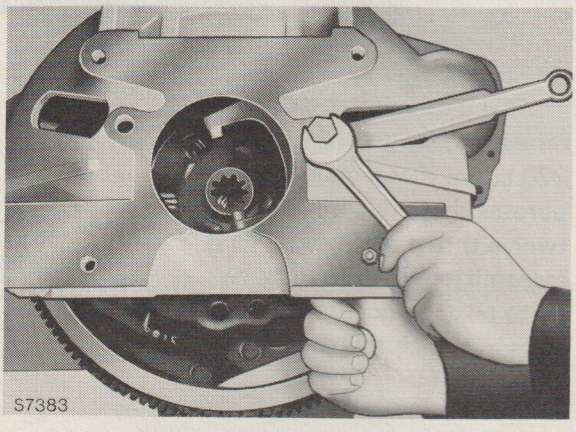
113a CLUTCH FORK AND RELEASE BEARING—Removal and Installation

Release bearing can be withdrawn after removing transmission assembly from clutch housing and backing-off clutch fork adjustment. Remove flywheel underpan where fitted.

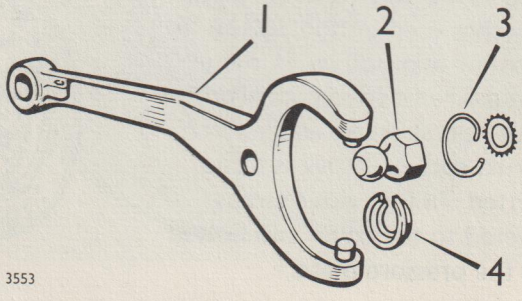
To gain access to clutch fork on 466 cu in. diesel engine, clutch housing must be removed. Fork ball stud is threaded into clutch housing.



To remove clutch fork on other engines, knock back locking tab from head of clutch fork ball support. Hold ball hexagon with a wrench and unscrew ball from support.



To release clutch fork (1) from ball (2), ease out snap ring (3) from groove in fork and remove retainer (4) from ball.



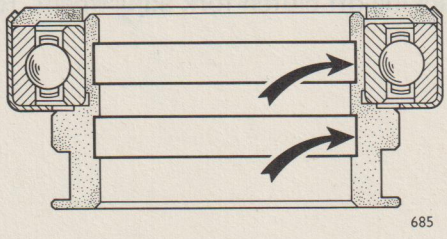
Before installing clutch fork, pack ball recess in fork, and ball retainer with recommended grease.

When installing clutch fork on 214 and 300 cu in. gasoline and 220 and 330 cu in. diesel engines insert support through rear face of clutch housing and assemble support to ball pivot, screwing it on approximately two threads. Tighten support, and holding support in position with a wrench, complete tightening of ball pivot. Secure support in position with tabwasher.

When installing clutch housing on a 466 cu in. diesel engine, ensure that housing is located on dowel each side of flywheel housing.

Before positioning release bearing in clutch fork, check that bearing slides freely on transmission front cover sleeve, and smear sleeve with recommended grease.

Release bearing bore has one or more recesses machined in the bore which should be filled with recommended grease prior to installation.

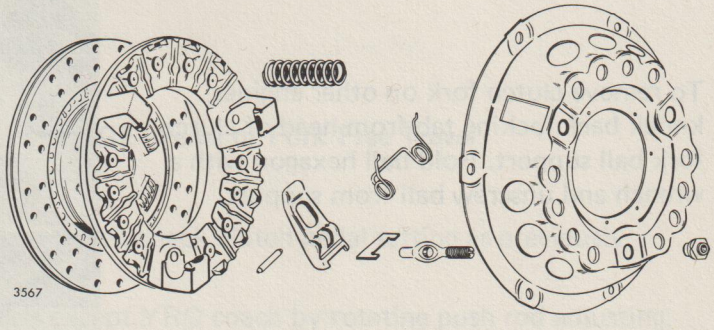

685

Before installing transmission assembly, lightly smear main drive pinion splines with recommended grease.

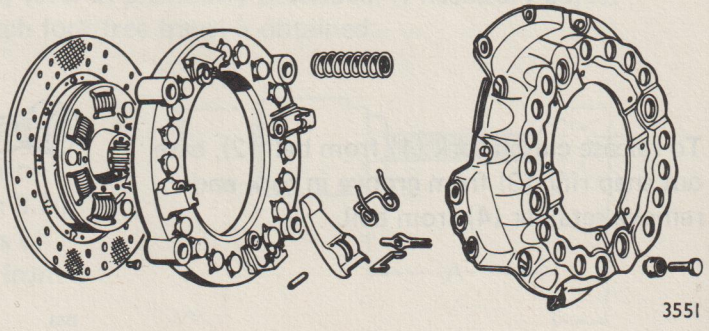
Adjust clutch pedal or fork free travel as described in Section 112a.

114 CLUTCH

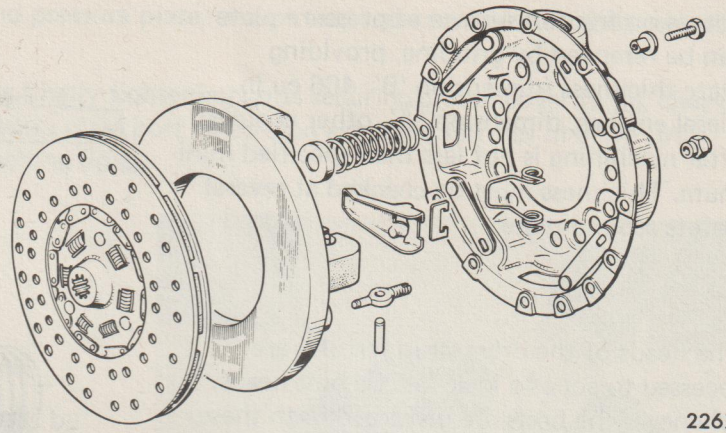
The 10 in. diameter clutch used on 214 cu in. gasoline and 220 cu in. diesel engines incorporates three release levers and twelve thrust springs. Drive is transmitted via the pressure plate posts which locate in slots in the clutch cover.


3567

The 12 in. and 13 in. diameter clutches used on the 300 cu in. gasoline and 330 cu in. diesel engines respectively incorporate four release levers and sixteen thrust springs. Drive is transmitted via four drive straps riveted to the cover and bolted to the pressure plate.


3551

The 14 in. diameter clutch used on the 466 cu in. derated (P) diesel engine and the 15 in. diameter clutch used on coach (C) and truck (R) 466 cu in. diesel engines incorporates four release levers and twelve thrust springs. Four drive straps are riveted to the cover and bolted to the pressure plate.



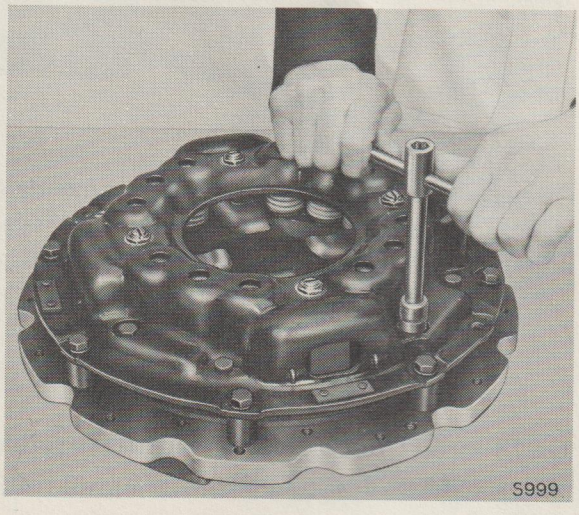
2267

114a CLUTCH—Removal and Disassembly

On the 466 cu in. engine, transmission and clutch housing should be removed separately, but on other engines access to clutch is gained after removing transmission and flywheel underpan.

Before separating clutch cover from pressure plate, mark cover and plate for alignment on reassembly if neither has to be renewed.

Use a clutch jig to compress thrust springs before removing eye bolt nuts, and where fitted, drive strap bolts and ferrules. On 14 in. and 15 in. diameter clutches, spacers are required between base plate and clutch cover.

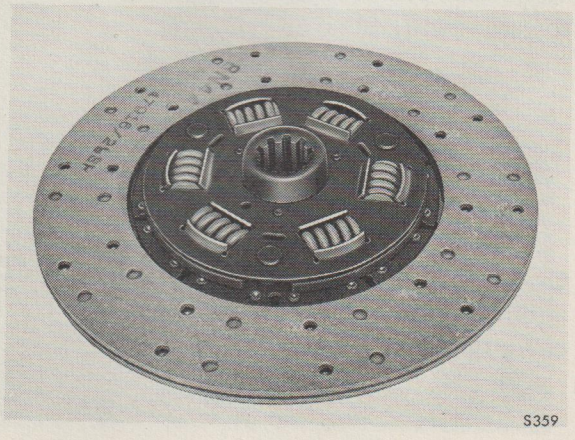


S999

114b CLUTCH—Inspection and Reconditioning

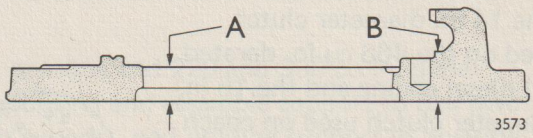
When renewing clutch disc friction facings, drill rivets sufficiently to allow them to be punched out. Do not shear rivets with a chisel as this may distort disc segments.

Install facing rivets with head of each radial pair alternately opposed on each side of clutch disc.

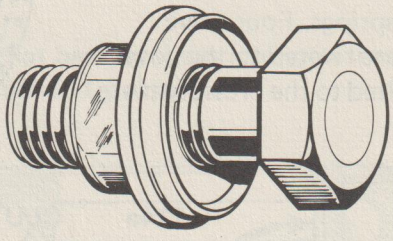


S359

Scores on friction surface of pressure plate can be removed by grinding, providing plate thickness (dimension 'B'; 466 cu in. diesel engines, dimension 'A', other engines) after machining is not less than specified minimum. Thickness must be checked at several points around plate.

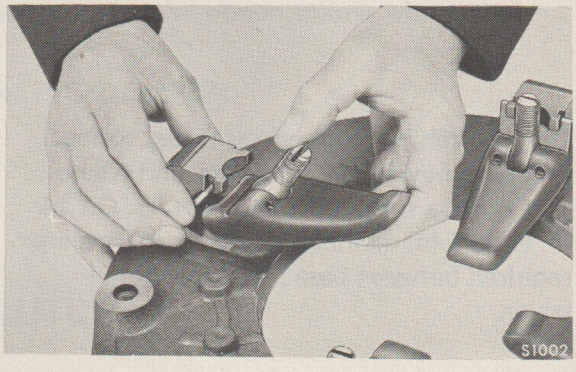


The heads of the drive strap ferrules are recessed to act as a lock for the bolt heads. Whenever the bolts are disturbed both these and the ferrules must be renewed. Bolts and ferrules are serviced as a kit.



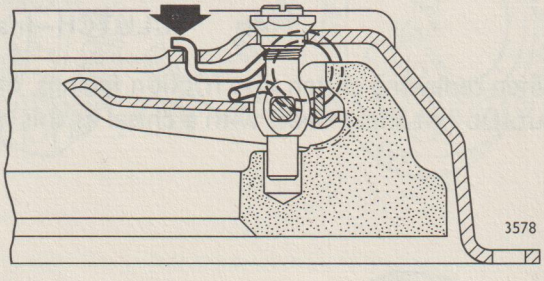
114c CLUTCH—Reassembly

On reassembly apply a smear of recommended grease to bearing surfaces of release levers, eye bolts, pins and struts.

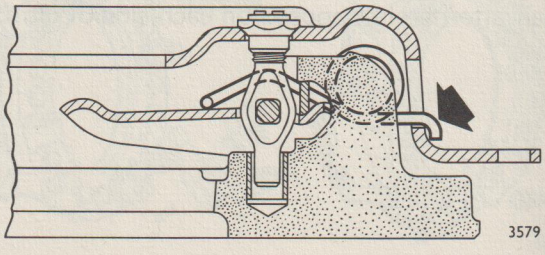


On 14 in. and 15 in. diameter clutches a spring cup must be assembled between each thrust spring and the pressure plate.

Install anti-rattle springs on 10 in., 12 in. and 13 in. diameter clutches with spring ends towards centre of cover.



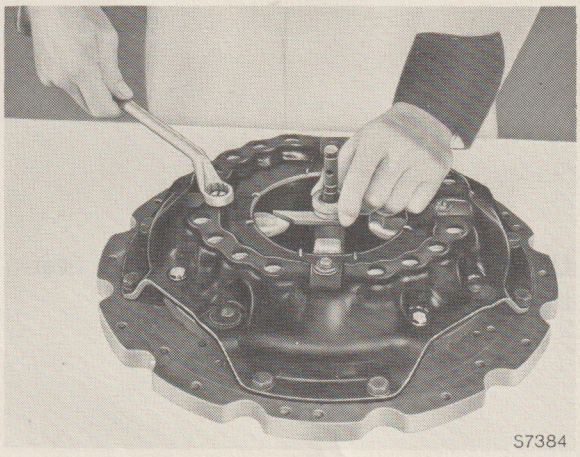
On 14 in. and 15 in. diameter clutches, install anti-rattle springs with hooked ends towards cover flange.



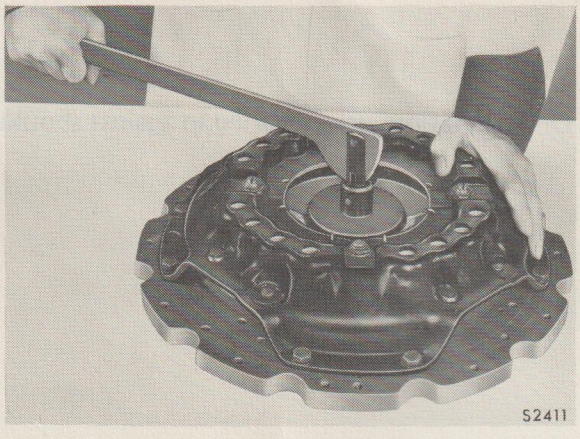
When reassembling original cover and pressure plate, ensure that marks made during disassembly are in alignment.

On clutches with drive straps, before finally tightening bolts securing clutch cover to jig, check that strap slots are aligned with pressure plate bolt holes then assemble ferrules in drive strap slots and loosely assemble strap attaching bolts.

Adjust release levers to specified height by turning eye bolt nuts.


S7384

Before locking eye bolt nuts, operate release levers several times and re-check adjustment.

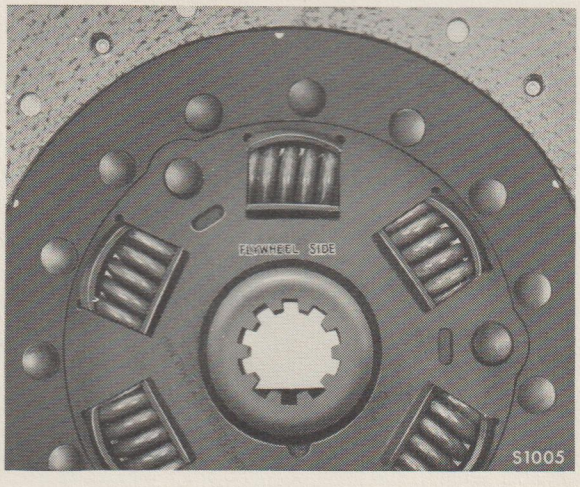

S2411

Before releasing clutch from jig, lock each eye bolt nut by staking nut into slot of bolt.

Where applicable, tighten drive strap bolts to specified torque then stake edge of ferrule on to bolt head.

114d CLUTCH—Installation

Install clutch disc with marked face towards flywheel. If marking is illegible, install disc with hub spring retainer away from flywheel.

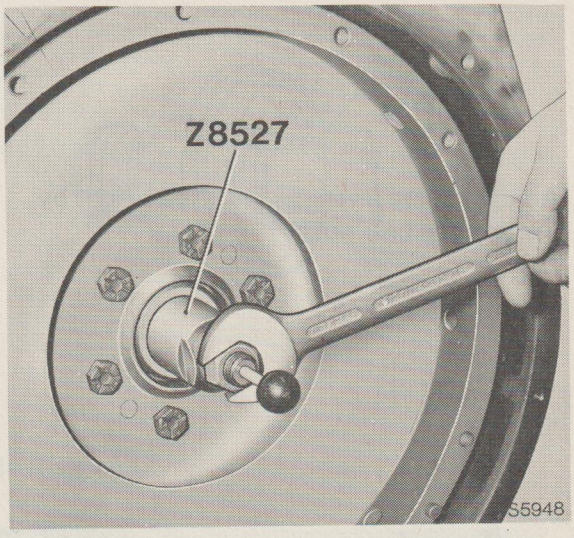


S1005

The transmission front cover sleeve and main drive pinion splines must be lightly smeared with recommended grease.

Adjust clutch pedal or fork free travel as previously described.

115 CLUTCH PILOT BEARING



Use Remover Z8527 to withdraw pilot bearing from crankshaft.

On installation, drive bearing in against shouldered face of crankshaft.

Body matter set in 11 point medium Univers, on IBM 72 Selectric Composer

Printed in England
Imprimé en Angleterre
UNWIN BROTHERS LIMITED, THE GRESHAM PRESS, OLD WOKING, SURREY

BEDFORD
SERVICE